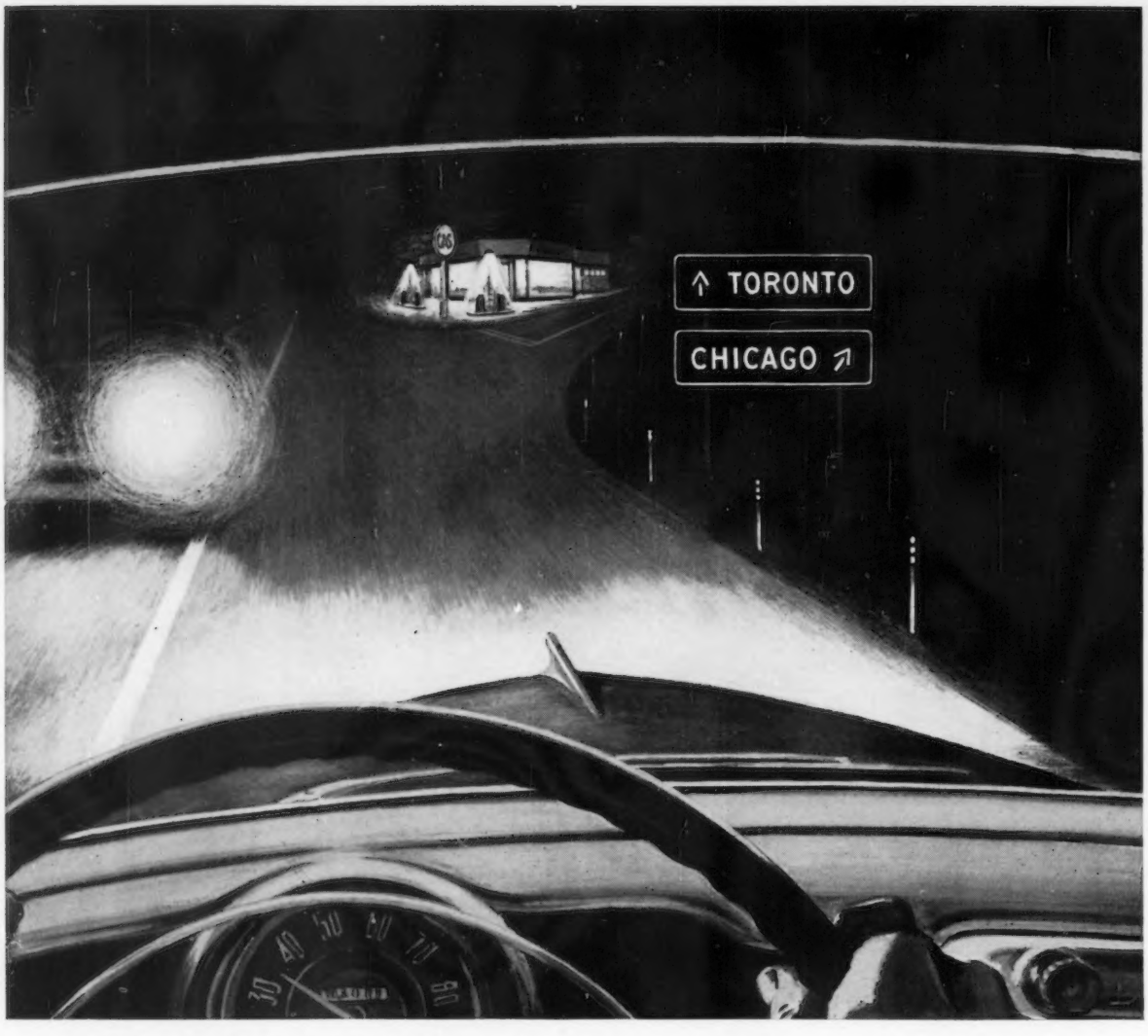
AUGUST, 1955

Traffic Engineering

Aerial View of Downtown Madison, Wisconsin

- One Year of Traffic Engineering in Madison
- Pittsburgh's Penn-Lincoln Parkway
- Measuring Traffic Engineering Through the Annual Inventory of Traffic Engineering Activities
- The Capacity of Urban Streets and Intersections

Official Publication of the Institute of Traffic Engineers



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Traffic Engineering

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COVER: Airview of Madison, Wisconsin, looking east. The State Capitol Building is in the center with traffic moving one way in a counter-clockwise direction around it. Lake Mendota on the north and Lake Monona on the south give the City of Madison an "hourglass" shape, approximately one-half mile wide just east of the State Capitol and approximately eleven miles long.

DEFINITION: Traffic Engineering is that phase of engineering which deals with the planning and geometric design of streets, highways, and abutting lands, and with traffic operation thereon, as their use is related to the safe, convenient, and economic transportation of persons and goods.

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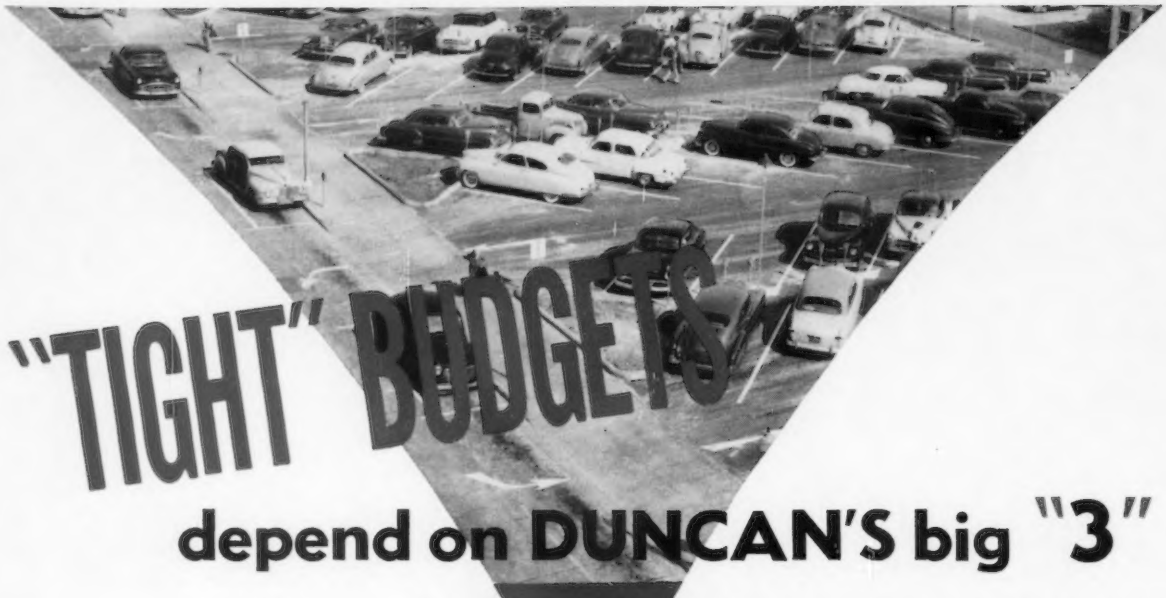

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Manufacturers of fully automatic and manual parking meters.

TO GIVE MORE "GO" on semi-traffic-actuated intersections, General Electric has developed a new Type V electronic controller (above, with accessories) and a new Type W electro-mechanical controller. Accessories, described below, may be used with either basic controller.

New G-E Type V Controller Can Take Full Line of Function-expansion Accessories

Here's what signal interval accessories do:

1. Actuated advance green split-phase timer provides for spasmodic left-turn movements against heavy or high-speed oncoming traffic.
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3. Pedestrian timer provides longer green interval, upon actuation, for persons on foot.
4. Synchronizer (pictured above without enclosure box) co-ordinates semi-actuated controller in single-cycle system.
5. Minor movement timer provides separate actuated movement in addition to normal major traffic phase.
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7. Single-phase extra-interval timer gives two-part change interval for a single phase.

For swift, efficient handling of any pattern within its scope, General Electric announces the new Type V electronic semi-traffic-actuated controller!

FOR FULL VERSATILITY in meeting varying needs at the intersection, and for flexibility in case the traffic pattern shifts, G.E. also announces a complete line of accessories which, when needed, can be quickly and easily added to the basic controller!

WITH THESE FUNCTIONS, the new Type V has traffic-moving abilities to meet almost any situation a traffic engineer can think of—yet is characterized by simplicity of installation, operation, and maintenance. All that's necessary to add an accessory, for example, is to plug it in or attach it to a terminal strip.

YOU'RE NOT LIMITED to an electronic controller, either. G-E's Type W (electro-mechanical) has been redesigned to accept the same accessories as the Type V. Either of these basic controllers can be your first "building block," no matter what degree of semi-traffic-actuation is required now or in the future.

FOR FULL INFORMATION on these new controllers and accessories, contact your authorized G-E traffic distributor or Apparatus Sales Office, or write Section 453-65, Outdoor Lighting Department, General Electric Company, West Lynn 3, Massachusetts.

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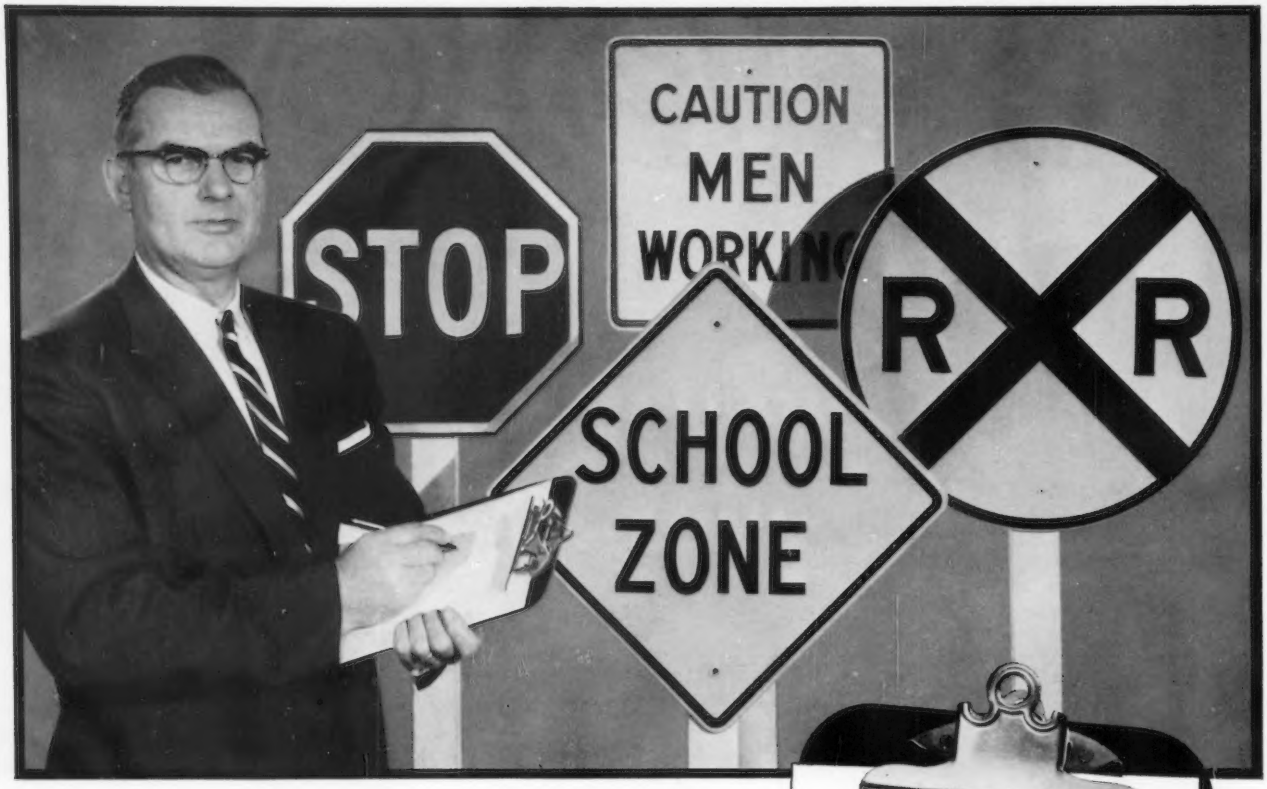
GENERAL ELECTRIC



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PAUL LEMCKE is a perfectionist. As president of Traffic Control Sign Co., Tacoma, Washington, his restless search for better ways to make better products has caused him to try just about every sign material on the market.

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12% Better Paint Coverage
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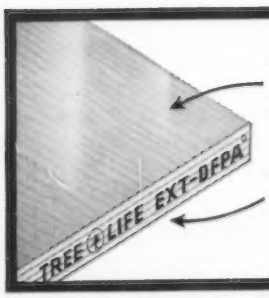

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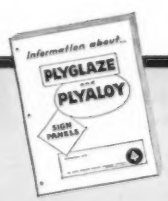
Top-quality Exterior fir plywood base, made with 100% waterproof glue.



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FOR THE FIRST TIME IN ALL-ALUMINUM

Two P & K developments that lend *new* flexibility and scope to traffic control planning!

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PERHAPS anyone can make a simple parking meter. Maybe anyone can even make an efficient one. But to *combine* extreme simplicity with unsurpassed efficiency takes some doing . . . and that's just what Dual has done.

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But let us give you *complete* information . . . plenty of logic and proof that Duals are *your* best choice . . . manual *or* automatic. Write *The Dual Parking Meter Company* (Subsidiary of The Union Metal Manufacturing Co.), *Canton 2, Ohio.*

For extra value get **DUAL PARKING METERS**

Frankly Speaking

MUCH HAS BEEN SAID and written in recent months about the need for a major increase in street and highway construction to meet the rapidly growing demands of a highly productive automotive industry.

Certainly the only proof needed is found in the long queues of impatiently waiting motorists that form in almost every city during heavy traffic hours. Or even observe the long lines of slowly crawling traffic on some of the more modern "Expressways" and "Parkways".

In this connection it should be opportune for us to take stock of the position of the Traffic Engineer in the program. He has been the one charged in the past with the responsibility of wringing the last drop of capacity and safety out of the outmoded systems.

It is recognized that there are inevitable compromises to be made between design and construction standards and operational needs in the interest of practical economics. However, the nation's streets and highways—even some of the most modern—furnish adequate evidence that these compromises have not always been of the proper order. Inadequate sight distances cannot be cured by a sign. Terminal facilities cannot be provided on land that has already soared in price due to the presence of heavy traffic volumes. Public transit cannot meet its share of the demand for transportation if it is not given proper consideration in the development stages.

No longer can an adequate traffic engineering job be done with a paint brush and a sign truck, as important as these will continue to be. The Traffic Engineer through his training, research, and experience with operating problems has assembled a vast store of information which should be useful in the future development.

The alert engineer will be ready to accept the challenge. He will accept new responsibilities of coordinating design and operation. He will fit public transit into the picture. He will be sensitive to maintaining a balance between access capacity and terminal capacity. He will maintain an interest in property values and the welfare of business in the community he serves. He will continue to employ signs, markings, and devices based upon engineering analysis and judgment.

Finally this is an administrative problem and demands the highest order of leadership to effectively meet the needs. Good Traffic Engineering should be synonomous with complete Traffic Management.

Thomas J. Leburn

Secretary-Treasurer

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in the modern manner . . .

The Electro-Matic® RADAR VEHICLE DETECTOR presents an entirely new concept in detection for traffic-actuated control. Situated *above* the street, the magic eye of radar operates continuously, unaffected by weather or climate. Completely electronic, it is dependable, accurate, and versatile. With no need for pavement excavation, the Model RD-1 Detector is readily moved or adjusted to roadway changes. It's easily installed on bridges, or wherever installation of regular detectors previously had been difficult.

There *are* many locations where nothing else can do the job as well, or as economically as the RD-1. Write for the copy of the new Radar Detector Bulletin D-154 for details.

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One Year of Traffic Engineering in Madison

By John H. Bunch, (Mem., ITE)
Traffic Engineer, Madison, Wisconsin

Fig. 1
Map of City of Madison, Wisconsin.

MADISON, THE CAPITAL CITY of Wisconsin and "The Ideal City in Which to Live" is located on a narrow strip of land which separates Lakes Monona and Mendota. The area of the city is much less than that of the lakes which give it its "hour-glass" figure. (See Figure 1.)

In 1950 the population of Madison was 96,056 people but growth and annexations had increased this figure to approximately 112,000 by the end of 1954.

In area the city covers a little more than 16 square miles. Only one-half mile wide between the lakes, its length extends almost 11 miles. Within these 16 square miles there are 230 miles of streets, 1,925 intersections and no alleys. While the street mileage is not unusual, the large number of intersections — many of which are irregular — and the lack of alleys, does create more than the usual number of traffic problems. Commercial deliveries in the business district are especially difficult as most of these are made from the street curbs.

Vehicle registration in Madison in 1954 amounted to approximately 38,460 units. On a population basis this is one vehicle per 2.78 people. For the county in which Madison is located the ratio is even less, being 2.44 with a vehicle registration of 73,695 units.

In summary, the problem which faced the city and the new traffic engineer in 1954 was an area of 16 square miles, one-half mile wide at its center and 11 miles long; serving more than 170,000 people and 73,695 vehicles; having 230 miles of streets; 1,925 intersections and no alleys; and *having no street which extended from city limit to city limit.*

ADMINISTRATION

Madison has the Mayor - Common Council type of government. Mayor George Forster has been with the city for nineteen years, serving in the capacities of City Comptroller, Personnel Officer, Acting City Manager and now is in his second term as mayor.

As the city operates under civil service regulations, approximately two years elapsed from the time that the traffic engineering department was authorized until the position was advertised, examination given and appointment made. In the authorization the ordinance provided:

"(1) TRAFFIC ENGINEERING DEPARTMENT. The Traffic Engineering Department shall be supervised by the Traffic Engineer who shall be appointed by the Mayor subject to confirmation by the Common Council and hold office under civil service. The Traffic Engineer shall supervise and carry out such traffic activities as shall be assigned to him by the Mayor and Common Council.

"(2) DUTIES OF TRAFFIC ENGINEER. The Traffic Engineer shall have supervision of all personnel engaged in street marking and traffic sign construction, alteration and repair, as well as maintenance and operation of traffic signals and the police and fire alarm system. The Traffic Engineer shall also have under his supervision and control the maintenance of parking meters and the collection of fees therefrom."

This ordinance, although brief, provided for activities which were budgeted as follows:

Administration	$ 15,000
Traffic Signs	76,871
Police and Fire Alarm	20,913
Parking Lots	23,044
Parking Meters	32,621
Street Lighting	97,102
	$265,551

In September, 1954, the budget for the same items for 1955 was developed and later approved for $312,847. Figure 2 shows the actual distribution.

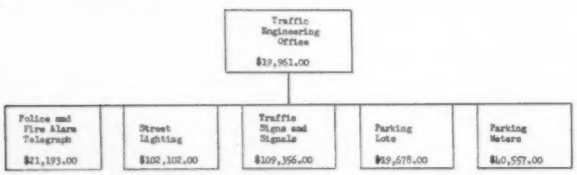


Fig. 2

1955 Budget Breakdown of the Madison Traffic Engineering Department.

Personnel assigned to the new department included those engaged in the same activities but employed in other departments. These included seven men on signs and street markings, three men on parking meters, four parking lot attendants and four electricians. In addition a secretary, a draftsman, and two engineering students from the University of Wisconsin were employed in the office. Later in the year the entire group was reorganized according to the chart in Figure 3.

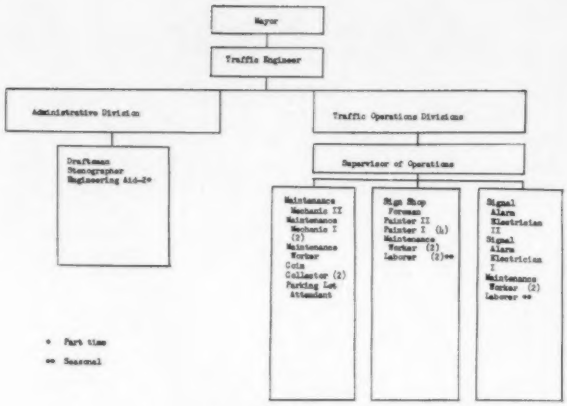


Fig. 3

Organizational chart—Madison Traffic Engineering Department.

ORGANIZATION

This being a new department it was decided in the beginning to proceed slowly, organize carefully and follow the general plan of:

1. Standardizing traffic control procedures and devices.
2. Making better use of existing facilities.
3. Developing basic data for long range planning and operation.

After adequate office equipment was secured a complete location file was developed for quick reference to all complaints, work orders, traffic counts, condition diagrams, collision diagrams, signal timing data, accident reports and other information pertaining to any particular location. A complaint-request form (Figure 4) was formulated whereby a

DEPARTMENT OF TRAFFIC ENGINEERING
MADISON, WISCONSIN

COMPLAINT-REQUEST RECORD

LOCATION _____ DATE _____

_____ BY _____

NAME _____ PHONE _____

ADDRESS _____

NATURE OF COMPLAINT-REQUEST

_____

_____

_____

_____

INVESTIGATION REQUIRED				COMPLETED By	COMPLETED Date
Accident Study	( )	Speed Study	( )		
Collision Diagram	( )	Obedience Study	( )		
Vehicle Count	( )	Loading Zone	( )		
Condition Diagram	( )	Street Lighting Study	( )		
Pedestrian Count	( )				
Curb Parking Check	( )	Circuit Check	( )		
Off-Street Parking Study	( )	Central Office Equipment	( )		

_____

DISPOSITION

Report to: _____ Date _____

Letter to: _____ Date _____

Work Order No: _____ Date _____

Hold: _____ File _____

Remarks:

Form TE-1

Fig. 4

Complaint-request record used by the Traffic Engineering Department of Madison in connection with every telephone call, letter or personal contact.

DEPARTMENT OF TRAFFIC ENGINEERING
MADISON, WISCONSIN

WORK ORDER AND REPORT

Nº 2624

DATE_____

LOCATION_____

TRAFFIC SIGNS	INSTALL	REPAIR	REPLACE	RELOCATE	REMOVE	SIZE	KIND	NO.
SIGN								
POST								
STUB								
OTHER								
STREET MARKINGS	**INSTALL**	**REPAIR**	**REPLACE**	**RELOCATE**	**REMOVE**	**COLOR**		**FT.**
CORNER RESTRICTION								
BUS STOP								
CROSSWALK								
CENTER LANE LINE								
PARKING STALL								
OTHER								
TRAFFIC SIGNALS	**INSTALL**	**REPAIR**	**REPLACE**	**RELOCATE**	**REMOVE**	**KIND**		**NO.**
TRAFFIC SIGNAL—FIRE ALARM								
HEAD								
PEDESTAL								
BASE								
LAMP								
CONTROLLER								
BOX								
CABLE								
DUCT								
TRAFFIC COUNTER								
OTHER								
PARKING METERS	**INSTALL**	**REPAIR**	**REPLACE**	**RELOCATE**	**REMOVE**	**12 Min**	**1 HR**	**2 HR**
METER								
PEDESTAL								
OTHER								

REMARKS:

AUTHORIZED BY: _____ COMPLETED BY: _____ ORDINANCE NO. _____

WORK ORDER BY: _____ MAN HOURS: _____ SECTION NO. _____

DATE PROMISED: _____ DATE COMPLETED: _____

DIAGRAM ON REVERSE SIDE ☐

Fig. 5
Work Order and Report.

record is made of every telephone call, letter or personal contact as it pertains to person, location, date, actual subject matter, type of study required and final disposition. A corresponding work order form (Figure 5) shows the required work to be done, material required, material used, man-hours of time used and person doing the work. These forms are serially numbered, cross-indexed and filed according to date and location for ready reference.

Work was also started on a set of basic maps on a scale of one inch equals two hundred feet, on which rights-of-way, street widths, traffic regulations, major traffic control devices and other pertinent data are shown.

On the theory that a traffic engineer is only as effective as he is able to put his ideas and knowledge to work, a series of meetings were held with the field personnel of the department. Subjects discussed were traffic sign types, sizes, colors, purposes, installation locations and maintenance; street paint markings, their types, colors, locations, purposes, and application; traffic signal operation, maintenance, and standards. The meetings resulted in a great improvement in the amount and type of work accomplished.

Progressive Madison has a Parking Utility Commission composed of the Mayor, Traffic Engineer, City Engineer, Captain of Traffic, Planning Director, two councilmen and three citizen members. The enabling ordinance authorizes this commission to issue bonds, acquire property (with Council approval), establish and operate parking lots and establish rates for parking.

Feeling the need for additional public support in the many Traffic Engineering activities, a Traffic Commission was established under the following ordinance:

"(–) TRAFFIC COMMISSION. (a) There is hereby established a Traffic Commission to serve without compensation consisting of the City Traffic Engineer, the Chief of Police, or in his discretion as his representative the Captain of the Traffic Division, a representative of the Common Council appointed by the Mayor, and one representative each from the City Engineer's office, the City Attorney's office, the City Plan Commission, and such number of other city officers and representatives of unofficial bodies as may be determined and appointed by the Mayor. The Chairman of the Commission shall be appointed by the Mayor and may be removed by him.

(b) It shall be the duty of the Traffic Commission and to this end it shall have the authority within the limits of the funds at his disposal, to coordinate traffic planning activities, to carry on education activities in traffic matters, to rereceive complaints having to do with traffic matters, and to recommend to the Common Council, the Mayor, the Board of Public Works, the Traffic Engineer, the Chief of Police and other appropriate city officials ways and means for improving traffic conditions."

In determining additional representation on this Commission the Mayor asked the following organizations to select their own delegate, thereby giving such representation a more official status on the Commission: Chamber of Commerce, Motor Carriers, Air Force Ground Safety, Newspapers, University, PTA, AAA, Junior Chamber of Commerce, Bus Company, State Motor Vehicle Department, Board of Education, Superior Court, City Fire Chief, Law Association, and Federation of Labor.

PARKING

The first major project completed was a comprehensive parking study for this group. The study covered fifty blocks in the central business district. The inventory showed the number of curb spaces, number of meters, time limits, parking restrictions and prohibitions and all other uses of curb space. Also, the location, size, capacity and use of all off-street facilities were checked.

For the collecting of parking data twenty-nine University students were hired and trained for the interviewing and coding. The interviewers recorded license number, vehicle type, type of facility, time parked and the departure of each vehicle and the destination of the parker. Data thus obtained was coded, checked, and transferred to tabulating cards, one card for each parking operation. Machine sorts and tabulations were then made to assemble this vast amount of information into workable tables and charts, such as Figure 6, which are the tools and materials of the traffic engineer for such a study.

The study showed a curb supply of 1,900 parking spaces, 1,522 parking spaces in municipal lots and 1,186 spaces in private lots. The total deficiency for the area was found to be 700 spaces. In order to provide for this, it was recommended that a present municipal lot be enlarged and double decked, another site be acquired for two-level parking and a third be enlarged. The recommendations are being followed.

With more than 1,400 curb parking meters and 800 parking lot meters, parking meter operation and maintenance is a major problem. While no additional curb meters

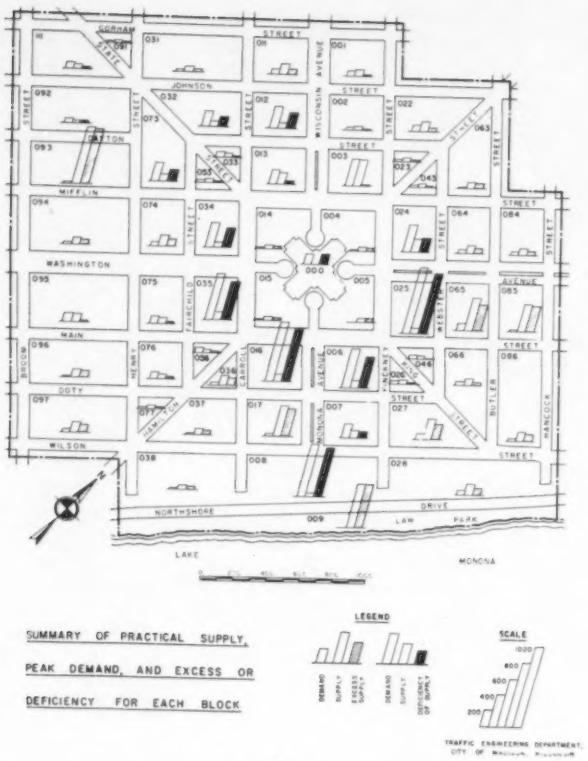

SUMMARY OF PRACTICAL SUPPLY, PEAK DEMAND, AND EXCESS OR DEFICIENCY FOR EACH BLOCK
LEGEND
SCALE
TRAFFIC ENGINEERING DEPARTMENT, CITY OF MADISON, WISCONSIN

Fig. 6
Typical parking study chart, showing parking supply and demand in the central business district of Madison.

were installed during 1954, attendants were dismissed from two municipal lots and meters were installed. With only gross receipts being recorded prior to this year a system has been devised whereby one week's collection each month is counted, recorded and compared for each block and each off-street lot. Metered lots have both two-hour and ten-hour meters and a separate accounting is made of each type meter. In this way meter usage is constantly checked. The traffic engineer has the authority to change the type of meter whenever it seems justifiable.

ONE WAY STREETS

The second major project was a system of one-way streets to speed the movement of traffic into and through the congested area. In 1949 a comprehensive O.D. study was completed. At that time, and with a city vehicle registration of 26,000 as against more than 38,000 in 1954, there was a daily average of 21,441 vehicle trips to the business district each day and 20,763 vehicle trips from downtown origins to outlying areas each day, a total of 42,204 vehicle trips having downtown origins or destinations. In addition there were 13,820 trips passing through the downtown area from west to east and 13,777 trips from east to west, a total of 27,597 trips daily through the C.B.D.

In total, the vehicle trips to or through the C.B.D. each day in 1949 was 69,801. If this volume increased according to vehicle registrations, the 1954 total would be more than 100,000 trips.

One-way streets have been used by many cities to provide for increasing traffic volume without the immediate necessity of actual street widening. This traffic regulation can be used to provide relief immediately and can serve as a temporary measure until actual widening can be accomplished, or as a semi-permanent regulation for traffic relief.

The one-way street plan for Madison may be divided into two parts. They are distinct parts, although one street is common to the two parts.

The first part involves traffic movements in the central business district. Circulating traffic in most business districts moves in a clockwise direction. This occurs because right turns at intersections are easier to make than left turns. In Madison, with traffic moving in a counter-clockwise direction around the Capitol Square, the predominant movements on those streets one block from the square are in the opposite direction. To prove this, counts were made on those streets one block from the Capitol Square, and the volumes were summarized in Figure 7. In one location it was found that 70% of the traffic followed this pattern while in another location 72% of the movement was according to this pattern. To expedite this circulation, the first ring of streets one block away from the Capitol Square will be one way, clockwise, counter to that on the Square.

The second phase of the one-way plan is illustrated in Figure 8. It involves a pair of one-way streets on the south side of the Square to provide better cross-town movement in this area as well as to fit in with the circular pattern just mentioned. In this respect Doty Street is paired with Wilson Street while also serving for circulating traffic. On the north side of Capitol Square, Johnson and Gorham Streets, which carry most of the cross-town traffic, were already one-way streets. Blair Street was the beginning or ending point of one-way traffic on the east side while Randall Street was the western terminus.

In direction, Gorham Street was eastbound while Johnson Street was westbound. These directions, contrary to normal operation, were originally proposed to satisfy two special conditions, bus movements to the east and State Route traffic in the western part of the city. Since they were put into operation in this manner, serious problems have been created

24 HOUR TRAFFIC IN THE OUTER RING OF THE CAPITOL SQUARE BUSINESS AREA

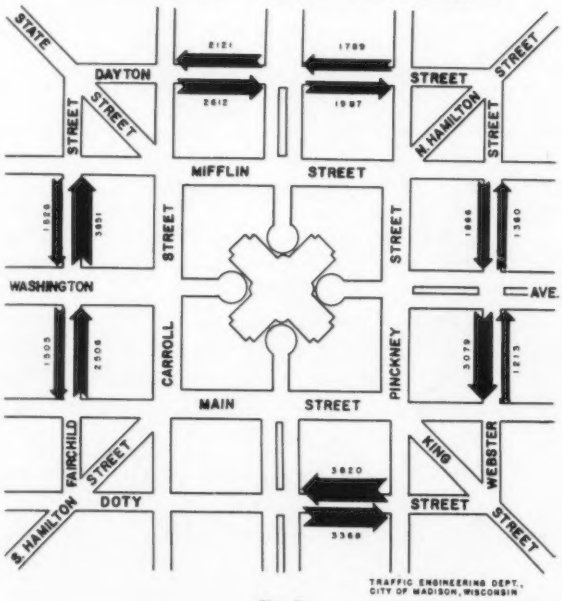


Fig. 7

Fig. 8
Proposed one-way street system for the City of Madison.

at the intersection of Gorham Street and Blair Street. All traffic westbound on Gorham Street from the northeastern part of the city had to turn left to Johnson Street while all eastbound State Route traffic on Gorham Street was making a righthand turn at the same point. In addition, this eastbound traffic turned left at Johnson Street which is one block from Gorham Street, and, in so doing, created a directional conflict with westbound traffic on Johnson Street. This has resulted in numerous accidents and many requests for traffic signals. There was also created a similar conflicting movement in the University area when this traffic moved back to its own side of the street.

Further, westbound traffic on Johnson Street, which was trying to get to University Avenue as soon as possible, went west on Johnson Street, then on State Street to Gilman Street, then left to University Avenue. In the same area, eastbound traffic on Gorham Street had turned in order to move toward the Capitol Square. By reversing traffic flow, the two movements on State Street ware eliminated and traffic counts have shown that the elimination amounts to more than 12,000 vehicle blocks of travel on State Street each 24 hours.

The efficient use of this pair of streets, Johnson and Gorham, was increased by reversing their direction and extending them four blocks farther east. At this point a pair of cross-town one-way streets provide a direct connection to the south side of the narrow isthmus as well as an easy turning movement on to and off these two streets. For a beginning, traffic on Johnson Street turns right and then left to start its one-way movement while eastbound traffic is not required to turn. The proposed pair of one-way streets, Ingersoll and Brearly, are narrow streets and they serve both Johnson and Gorham Streets and also better accommodate parking throughout their entire length. At the west end Orchard and Charter Streets are one-way streets for a similar cross-town movement in that area.

Added refiniements to the system include channelizing islands at the four corners of the Capitol Square to provide for right turns only on to and off the square. Traffic signal installations, inter-connections and synchronizing on parts of University Avenue, State Street and Dayton Street have been completed.

Madison has many narrow streets as do most of our older cities. In order to maintain parking on both sides of these streets one-way traffic had to be accepted. The widening of these narrow streets was almost a physical impossibility, but one-way traffic operations were instituted with very little delay.

FOOTBALL GAMES

Football traffic every fall has always been a headache for the police officials. With a great deal of advance planning between the Police Department and the Traffic Engineering Department the city is cleared of post-game traffic in forty minutes. The planned circum-urban route for Madison has been completed on the east, south and west sides of the city. Fortunately, it intersects all of the major highways leading to Madison. From this circum-urban route there are four major streets available to the stadium; one from the east, two from the south and one from the west. A minor street from the southwest is used for overflow traffic.

In the original planning the capacities of these streets were compared to the total volumes of traffic which the intercepted highways might carry. The circum-urban route was then divided into comparative segments, one for each street. It was found that major traffic volumes originate in Milwaukee, Chicago and Minneapolis-St. Paul. Informational and directional signs were then erected on all routes as determined by the traffic capacities. Police officers were also stationed at all major intersections and two-way radio was available in all the police cars.

In cooperation, Colonel Nelander of Truax Air Field provided an Air Force helicopter for aerial observation. This helicopter was also equipped with a police two-way radio. Beginning one and one-half hours before game time and continuing until all spectators had left the stadium traffic was moved into and out of the area with few interruptions due to direct radio contacts and directions to all control points. To correct particular problems and improve subsequent operations aerial photos were taken by a photographer from a local newspaper for perusal in a more analytical manner.

Another innovation used in this plan was to move traffic by reversing a one-way street after game time on the one route that traversed the business district. This was done by placing a police officer at each of the nineteen intersections of the one-way street. After game time, by a pre-determined signal, the officers made the change simultaneously. By such action seven traffic lanes were made available for the movement in the area immediately adjoining the stadium.

STREET LIGHTING

During the year of 1954 street lighting was also added to the department's responsibilities. This includes both location and type of installation and the development of a comprehensive street lighting program. Plans were prepared for the installation of 17,000 feet of new mercury vapor street lighting on East Washington Avenue. The luminaires are 20,000 lumen size, mounted at a height of thirty feet. They are located at the side of the roadway, suspended at a point six feet out from the curb and spaced approximately 115 feet for 1.0 foot candle, center to center. Intersection lighting was the controlling factor in the actual spacing. Overhead type wiring was used for electrical service. This plan for lighting East Washington Avenue is the first step in the development of a complete street lighting program for the city.

TRAFFIC CONTROL SIGNALS

Prior to the organization of this department, Madison had only thirty-five signalized intersections. With diagonal streets radiating from the four corners of the Capitol Square these very irregular intersections have had a separate pedestrian walk interval for many years and it has worked quite satisfactorily. Similar intervals at other intersections have not proven so effective and, except where needed and actuated by push buttons at those intersections where turn arrows provide extra movements, they will be removed and regular walk-wait lights installed. There have been six new signal installations and twenty others modernized in the past year, with all signals being inter-connected.

LANE SIGNALS

University Avenue between Farley Avenue and Old Middleton Road is a three-lane concrete pavement thirty feet wide. Recent traffic counts have shown that there is considerable daily traffic movement into and out of Madison from this section of highway. In the morning the inbound volume of traffic is approximately three to one over the outbound and this situation reverses itself in the afternoon. To provide better use of these three lanes directional signals are soon to be installed overhead at nine locations in this length of highway. These signals will operate automatically and will permit inbound traffic to use two lanes in the morning with one lane for the outbound traffic. There will be two lanes for outbound traffic in the afternoon and one lane for the inbound. To make the nine installations either existing poles will be used or new poles will be installed for the purpose.

Fig. 9
East Washington Avenue in Madison, looking easterly from the Capitol Square. This street was recently repaved and left turn slots provided in the center islands where needed.

All signals will be operated by one controller through five conductors. These conductors will be mounted on a five-spool rack. One service connection at a point centrally located will be sufficient as the total load will never be more than 3,500 watts. The weight will be approximately 120 pounds at each location with the load fairly well distributed. With the installation of these lane signals plus the recent synchronizing of all signals on University Avenue, traffic flow on this heavily traveled street will reduce crossing time to a minimum.

PAVING

During 1954 1.1 miles of streets were widened and 146 miles of street paved. Part of the street improvement project is shown in the picture of East Washington Avenue in Figure 9.

WALL MAP

An additional innovation in traffic engineering operation during the past year is the map of the entire city (scale—1″ equals 200′) which occupies one wall in the traffic engineering office. Tags of one color denote contemplated construction while tags of a second color indicate actual work being done by both private and municipal groups. These tags also show detours, street closures and barricades. This gives the traffic engineer a quick picture of which streets are usable and which are closed. The Police and Fire Departments are notified each day of the changes. Spotting the proposed construction areas allows for necessary detour signs to be made in advance of the actual closing of the streets.

Yes, for a Traffic Engineer, also, Madison is a good place in which to live. But if the troubles get too great he can always go fishing.

BE SURE TO ATTEND—

FOUNDERS 25th BIRTHDAY MEETING

Pittsburgh, Pennsylvania

OCTOBER 24-27, 1955

Pittsburgh's Penn-Lincoln Parkway

By H. K. Van Riper (Assoc. Mem., ITE)
Assistant Chief Engineer in Charge of Design,
Pennsylvania Department of Highways, Harrisburg, Pennsylvania

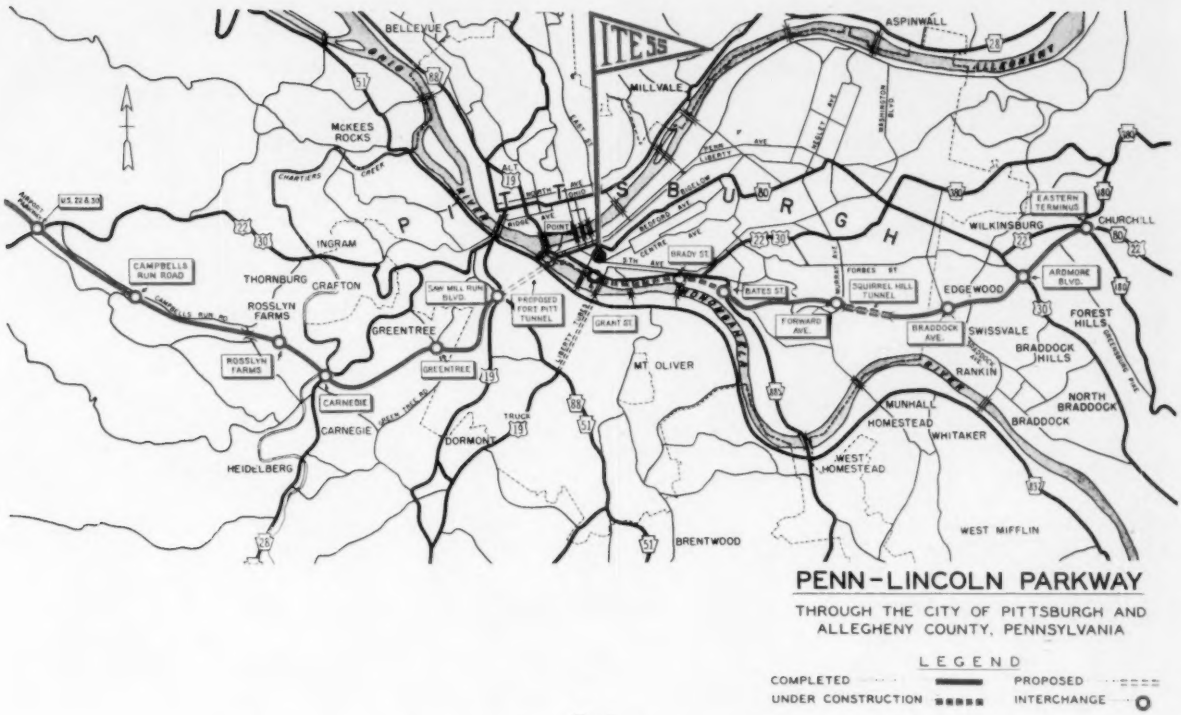


Fig. 1
Penn-Lincoln Parkway through the City of Pittsburgh and Allegheny County, Pennsylvania.

INTRODUCTION

THE PENN-LINCOLN PARKWAY is not a parkway as that term is generally understood by highway engineers. It is a multiple-lane limited-access highway open to all types of vehicles—passenger cars, trucks, and buses.

The Parkway is designed to move traffic smoothly and efficiently over extremely rugged terrain, and through a highly industrialized metropolitan area.

The over-all length of the Parkway is 19½ miles, on new location throughout as shown in Figure 1. It follows a general east-west direction from U. S. Route 22 in Churchill Borough, approximately nine and a half miles east of downtown Pittsburgh, into the famed Golden Triangle at the junction of the Allegheny and Monongahela Rivers. Continuing westwardly for a distance of ten miles, it connects with U. S. Routes 22 and 30 at the Airport Boulevard leading to the Greater Pittsburgh Airport.

The over-all conception of the Penn-Lincoln Parkway embraces seven parts: (1) the Parkway East, (2) the Downtown Interchange, (3) the Crosstown Boulevard Connection, (4) the Point Interchange, (5) the Fort Pitt Bridge, (6) the Fort Pitt Tunnel, and (7) the Parkway West.

The Parkway East covers the section from the eastern terminus on U. S. Route 22 in Churchill Borough, to Bates Street Interchange, in downtown Pittsburgh, a distance of about seven miles, and includes the famed Squirrel Hill Tunnel. This section of the Parkway was opened to traffic in June, 1953. Interchanges at Forward Avenue and Bates Street are shown in Figures 2 and 3.

The Downtown Interchange includes the section between Bates Street and the existing Fort Pitt Boulevard (Water Street) at Smithfield Street, in the Triangle, a distance of about two and a half miles. This section is under construction and all work is scheduled to be completed late in 1958. (See Figure 4.)

The Crosstown Boulevard connection covers the interchange facility located at the east approach to the Liberty Bridge, and together with the Boulevard of the Allies provides a connection between the Penn-Lincoln Parkway East and the proposed Crosstown Boulevard. This section remains to be placed under contract.

The Point Interchange covers the layout of ramps in the Point area, connecting Parkway East and Parkway West with the Fort Duquesne Bridge over the Allegheny River, Duquesne Way and the existing street network in the Triangle. The design of this interchange is nearing completion, and the artist's conception is shown in Figure 5.

The Fort Pitt Bridge will carry the Parkway West over the Monongahela River, and will be located a short distance up stream from the present Point Bridge. The new Bridge

Fig. 2
FORWARD AVENUE INTERCHANGE—Four bridges and two and a half miles of ramps provided for in the construction of the Interchange. Difficult terrain restricted design of several Parkway interchanges.

will be a double-deck structure, with eastbound traffic using the upper level and westbound the lower level. Substructure work for the new bridge is now underway.

The Fort Pitt Tunnel will connect the Parkway West at the Saw Mill Run Interchange with the proposed Fort Pitt Bridge. The Tunnel is in the preliminary design stage and is to be built by the Pennsylvania Tunnel Commission.

The Parkway West covers the section from the Saw Mill Run Interchange to the western terminus on combined U. S. Routes 22 and 30 at the Airport Boulevard, a distance of nearly ten miles. This section was opened to traffic during October, 1953.

HISTORICAL BACKGROUND

For over a period of two decades, the main highway arteries leading into and through the City of Pittsburgh to the Downtown Triangle from the east and the west have been seriously overtaxed. The east-west highway arteries traversed congested areas both in the east and west end of Pittsburgh. Intersecting streets with their numerous traffic signals, bad alignment, heavy grades, and overcrowded conditions, all combined to cause traffic delays. These conditions were aggravated by the ever increasing traffic volumes.

The Downtown Triangle, bounded by the Allegheny and Monongahela Rivers and Eleventh and Grant Streets, comprises an area of less than one-half square mile. This is the nerve center of a metropolitan area in Allegheny County, with a population of more than one and a half million people.

Highways converge to this center from all points of the compass. Approximately 300,000 vehicles pour into and out of the area every working day. The streets and river bridges are woefully inadequate to handle the heavy traffic volumes, and as a result, intolerable congestion occurs, especially during the morning and evening peak-hour traffic periods.

The problem which promoted the planning and studies for an east-west relief route was essentially that of providing a safe, modern and convenient thoroughfare, adequate to accommodate traffic originating east and west of Pittsburgh destined for the metropolitan area, and to provide for through traffic on the principal east-west routes, namely, U. S. Route 22 (the William Penn Highway) and U. S. Route 30 (the Lincoln Highway), giving adequate consideration to servicing the intervening areas.

Demands for traffic relief culminated in independent studies by local traffic and planning agencies. The efforts of these fact-finding groups crystallized opinion until there was substantial agreement that a new express facility should be boldly designed to meet topographic difficulties and to provide adequate capacity for present and future traffic needs. It was the concensus that only a multi-lane highway, having access at a few strategic street intersections, could possibly provide the essential relief.

Local planning agencies, the U. S. Bureau of Public Roads and the Pennsylvania Department of Highways were in general accord on the location and plan to be used to solve this problem. More than twenty-five years of planning, education and promotion were encompassed in bringing the Penn-Lincoln Parkway into being.

ROUTE LOCATIONS

Parkway East

Routes Studied

The terrain permitted little choice in the location of the Parkway between the eastern terminus, about one mile east of Wilkinsburg on the William Penn Highway (U. S. 22), and the more highly developed area in the vicinity of Swissvale and Edgewood.

Between the Edgewood - Swissvale area and downtown Pittsburgh, three route locations were studied. The adopted location follows along the southerly edge of Frick and Schen-

Fig. 3
THE BATES STREET INTERCHANGE, present western terminus of Penn-Lincoln Parkway East showing proximity to steel industry and one of numerous heavy cut sections. Parking on the ramp at the left was permitted prior to the opening of this section, but is not allowed now that the Parkway is open to this point.

Fig. 4
Part of Downtown Interchange, near Brady Street Bridge, under construction.

ley Parks, passing under the Squirrel Hill residential district by means of a tunnel. Thence it follows through the Greenfield section to the northern bank of the Monongahela River, and from there it parallels the Monongahela River and Second Avenue to the downtown triangle where it connects with the Fort Pitt Boulevard (Water Street) the proposed Crosstown Thoroughfare, Parkway West and the Point Park area.

The adopted location was considered to be the best because the route followed made use of the undeveloped portions of the Pittsburgh metropolitan area to a much greater extent than the other two alternate routes. Furthermore, the adopted route was very favorable in the matter of property damages.

Location Features

In the vicinity of the eastern terminus of the Parkway, open terrain across ridges and valleys was available for about two miles, and then the valley of Nine Mile Run was reached. The valley was followed on light grades until it diverged from the general dirction of the route location. It was then necessary to penetrate the high ground of Squirrel Hill by the tunnel of that name (see Figure 6). From the tunnel site a convenient ravine led to the valley of the Monongahela River, at a point about three miles from downtown Pittsburgh.

From the latter point, the area between the river and the bluff hillside was largely occupied by Second Avenue and the Baltimore & Ohio Railroad tracks and yards. Sufficient lateral space for the Parkway could be obtained only by relocating a section of the railroad tracks and Second Avenue. This work involved the construction of retaining walls and the excavation of portions of the steep hillside.

By this means, and by altering the Pennsylvania Railroad bridge and relocating the Baltimore & Ohio Railroad passenger and freight stations, the line reached Smithfield Street. Here the Parkway meets the existing Fort Pitt Boulevard (Water Street) on the Monongahela Riverfront, carrying the line to lower downtown and the Point area and connecting with the Parkway West.

PARKWAY WEST

The Allegheny County Planning Commission made the initial study for the location of the Penn-Lincoln Parkway west from the Triangle to the intersection of Campbells Run Road and Routes 22 and 30. The route adopted by the Department of Highways and approved by the Bureau of Public Roads follows very closely the location proposed by the County Planning Commission.

Fig. 5
Artist's conception of the Point Area Development in Downtown Pittsburgh.

The present general location of U. S. Route 22 and 30 to the west from the Pittsburgh city line, through Crafton, could not be satisfactorily developed. It was notoriously inadequate and limited as to potential improvements.

The adopted route extends from the Banksville Circle on Saw Mill Run Boulevard, at the south portal of the proposed Fort Pitt Tunnel, westward along Banksville Road, on new location, through Greentree, Carnegie, and Rosslyn Farm Boroughs and up Campbells Run valley to the western terminus on the Steubenville Pike (U. S. 22 and 30) at the Airport Boulevard.

In general, the Parkway West is located through relatively undeveloped areas where property damage could be kept to a minimum.

The proposed Fort Pitt Tunnel and the proposed Fort Pitt Bridge will connect the Parkway West with the Parkway East in the downtown business district by means of the Point Interchange and existing Fort Pitt Boulevard (Water Street).

Location Features

From the Saw Mill Run Boulevard at the south portal of the proposed Fort Pitt Tunnel, the line climbs over the ridge at Greentree—a rise of about 400 feet. This is accomplished by the use of a five percent grade, approximately 7600 feet long.

Westward from Greentree, it is necessary to descend to the valley of Chartiers Creek, and this is done by means of a five percent grade through undeveloped territory.

At Carnegie, the line is carried over Pennsylvania Route 519 and Chartiers Creek on a high-level structure, in order to avoid excessive costs.

From Chartiers Creek, a series of five percent grades carry the line over a low summit, across the valley of Campbells Run on a high steel arch structure, and over another low summit to re-enter the valley of Campbells Run. This valley is then followed on light grades through undeveloped country to the western terminus of the Parkway at the intersection with the William Penn Highway, U. S. Routes 22 and 30.

PARKWAY TRAFFIC

Studies of the probable traffic demand on the Parkway East were made by the Bureau of Traffic Planning of the City of Pittsburgh, in 1942 and 1943. These were supplemented by an origin and destination survey conducted by the Department in 1945. Further studies were made in 1947 of the probable traffic expected to use the Parkway West.

It is estimated that by 1960 there will be a volume of over 31,000 vehicles per day using the Parkway between the Ardmore Boulevard and Braddock Avenue Interchanges; about 40,000 vehicles passing through the Squirrel Hill Tunnel; more than 56,000 vehicles crossing the double-deck Fort Pitt Bridge, and approximately 43,000 vehicles passing through the proposed Fort Pitt Tunnel.

At the western terminus of the Parkway West, the traffic volume for the same period is expected to rise to more than 25,000 vehicles per day. A large portion of this traffic will be generated by the Greater Pittsburgh Airport.

These estimates were made on the basis of a completed Parkway improvement from the eastern terminus in Churchill Borough, to the western terminus at the Airport Boulevard, including the Downtown Interchange, Point Interchange, and, in addition, the Crosstown Connection and the Ohio River Boulevard Extension in North Side Pittsburgh.

Although the Parkway will not be completed for some time, the traveling public is now receiving susbstantial benefits from the completed sections. The travel time from U. S. Route 22 in Churchill to the Triangle Area has been reduced by approximately thirty minutes; from U. S. Route 30, Ardmore Boulevard, to the Triangle Area has been reduced by twenty-five minutes; and from the Greater Pittsburgh Airport to downtown Pittsburgh by thirty minutes. This is a total savings of sixty minutes for travel between terminal points as compared to the former routes during peak hours.

Traffic counts taken during the month of April, 1955, show that 35,200 vehicles were passing through the Squirrel Hill Tunnel during a 24-hour period, with 22,000 vehicles using the section between the Greentree and Saw Mill Run Boulevard interchanges.

DESIGN FEATURES

Roadway

The Parkway has been designed as a limited access highway, with grade separation structures provided at all cross roads and entrance and exit possible only at the interchanges.

Fifteen interchanges have been provided—ten major and five minor—at the following locations:

Major Interchanges

Ardmore Boulevard
Braddock Avenue
Forward Avenue
Brady Street
Grant Street
Point Area
Saw Mill Run Boulevard
Greentree Borough
Carnegie Borough
U. S. Routes 22 and 30 (western terminus)

Minor Interchanges

Greensburg Pike
Bates Street
Carson Street
Rosslyn Farms
Campbells Run Road

The rugged topography, characteristic of the Pittsburgh area, has resulted in heavy grading quantities and the con-

Fig. 6
EAST PORTAL OF SQUIRREL HILL TUNNEL — The portal is veneered with a cross-grain sawed grayish colored sandstone, which blends with the buff-colored brick of the ventilating building.

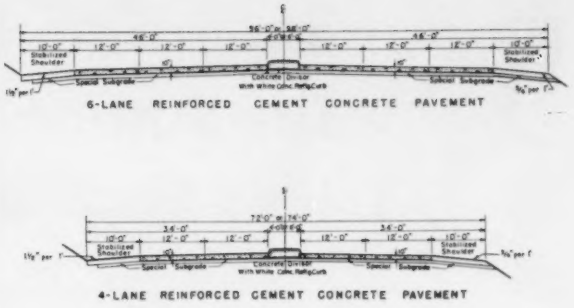


Fig. 7
Typical cross-sections for the four-lane and six-lane Penn-Lincoln Parkway East.

struction of numerous structures in order to meet design requirements of a maximum grade of five percent, maximum horizontal curvature of four degrees, and a design speed of sixty miles per hour. All curves in excess of two degrees are provided with transitions.

On Parkway East, the width of the graded section, shoulder line to shoulder line, ranges from 72 feet to 98 feet, depending on the number of traffic lanes and width of the divisor. On Parkway West, the width ranges from 72 feet with a four-foot paved divisor, to 88 feet with a 20-foot earth divisor.

The type of roadway pavement provided for on the Parkway is ten-inch uniform depth reinforced cement concrete, with a six-inch special subgrade of granular material.

On the ramps of the interchanges, the same type of pavement is used as on the Parkway proper, except the depth is either nine or ten inches.

On Parkway East, four traffic lanes are provided from the eastern terminus in Churchill Borough to the westerly end of the Squirrel Hill Tunnel, and six lanes from the latter point to the existing Fort Pitt Boulevard in the downtown triangle. The roadway consists of two or three 12-foot lanes on each side of a four or six-foot concrete divisor, with ten-foot stabilized shoulders (see Figure 7).

On Parkway West, four lanes are provided throughout except on the five per cent grades east and west of the Greentree Interchange summit. Here an additional climbing lane twelve feet wide is provided—one and two-hundredths miles long for westbound traffic and four-tenths of a mile long for eastbound traffic.

The four-lane roadway pavement consists of two twelve-foot lanes on each side of a four-foot concrete divisor, except for two and nine-tenths miles at the extreme western end of the Parkway. On this latter section a variable ten-foot to twenty-foot earth medial strip replaces the four-foot paved divisor.

THE DOWNTOWN INTERCHANGE

Although the design of any interchange on an expressway challenges the ability of a designer, the complexities in this instance were increased manifold by an unfavorable topography of a congested area, main line and terminal facilities of two major railroads, commercial and industrial buildings, five main river bridges, as well as the existence of arterial and secondary streets in the immediate vicinity. Engineers of the Bureau of Public Roads referred to the problem as the most difficult of any coming to their attention for similar urban expressways.

One of the problems involved in the design of the Downtown Interchange was the relocation of the yard tracks and both the freight and passenger terminals of the Baltimore & Ohio Railroad Company, including the maintenance of operations and services during construction.

In order to accomplish an acceptable design and to provide for the construction of new railroad facilities within the available restricted area, it was decided to relocate a section of Second Avenue and to separate the eastbound and westbound roadways of the Parkway with the main line tracks of the Baltimore & Ohio Railroad located in between. The related railroad work and the more involved design of the Parkway added immensely to the cost of the work.

Over $7,000,000 in contract construction is under way in the Downtown Interchange, and among other work there is included the relocation of Second Avenue, the widening and reconstruction of the Boulevard of the Allies, and alterations to the Brady Street Bridge.

The work remaining to be placed under contract in the Downtown Interchange, including the Crosstown Boulevard connection, railroad structures, and the uncompleted portions of the Parkway, is hoped to be completed by 1958.

Related contracts covering the construction of new railroad freight and passenger stations and the relocation of track facilities are estimated to cost an additional $4,000,000.

FINANCING

The work completed and under construction on Parkway East and West, and in the Downtown Interchange, is being financed mainly by Federal-aid funds, Highway and Bridge Authority bond money, and by State funds. On Parkway East, the City of Pittsburgh made a contribution of $1,000,000 and the County of Allegheny $5,000,000.

WORK TO BE DONE

Not less than five years' time ahead before the overall project will be completed is the present forecast. There remains to be done the uncompleted portion of the Downtown Interchange, the Crosstown Boulevard Connection, the Point Interchange, the Fort Pitt Bridge and Carson Street Interchanges, and the Fort Pitt Tunnel.

(Continued on page 455)

Measuring Traffic Engineering Through The Annual Inventory of Traffic Engineering Activities

By Maxwell Halsey, (Mem., ITE)

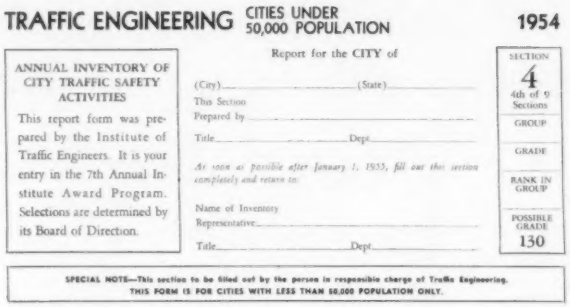
Executive Secretary, Michigan State Safety Commission, Lansing, Michigan

(A word about the Author: Mr. Halsey is Chairman of Committee 1-F of the ITE Technical Council, which is concerned with the subject of this article. His career is highlighted by several interesting firsts. In 1926, he received the first graduate fellowship offered by the Bureau for Street Traffic Research at Harvard University. He was one of the 19 charter members of the Institute of Traffic Engineers in 1930, and two years later became one of the first State Traffic Engineers for the Department of Public Works of Massachusetts. In 1942 he became the first Executive Secretary of the Michigan State Safety Commission, the position he holds at the present time. Mr. Halsey's three books have carried on his series of "firsts". "Traffic Accidents and Congestion" (John Wiley & Sons—1941) was one of the first books dealing exclusively with the principles of traffic engineering. "State Traffic Safety" (Eno Foundation—1953) was the first book dealing with State Safety Organization and Programs. "Let's Drive Right" (Scott Foresman and Company—1954) was the first full scale high school textbook written by an independent author. A fourth book is now being completed, dealing with "Driver Control" through education, the police, the courts and driver license administration. Mr. Halsey's wide range of experience brings to this article a broad approach and helps to place the Traffic Engineering Inventory in its proper perspective.)

TRAFFIC ENGINEERING has come a long way since nineten traffic engineers met on October 2, 1930, to create the Institute of Traffic Engineers. Another milestone was reached in 1947 when an inventory of traffic engineering activities was begun through the Annual Inventory of Traffic Safety Activities administered by the National Safety Council.

The essential lever to have annual inventory forms filled out was the National Traffic Safety Contest which began in 1932. By 1947 the Contest was changed to the Annual Inventory of Traffic Safety Activities and included the following eleven areas of activities:

(1) Death Records
(2) Accident Facts (Records Bureau)
(3) Traffic Legislation
(4) Traffic Engineering
(5) Driver Education
(6) Motor Vehicle Inspection
(7) Courts
(8) Public Information
(9) Safety Organization
(10) Enforcement
(11) Driver Licensing



TRAFFIC ENGINEERING CITIES UNDER 50,000 POPULATION 1954

ANNUAL INVENTORY OF CITY TRAFFIC SAFETY ACTIVITIES

This report form was prepared by the Institute of Traffic Engineers. It is your entry in the 7th Annual Institute Award Program. Selections are determined by its Board of Direction.

Report for the CITY of

(City) (State)

This Section Prepared by

Title Dept.

At soon as possible after January 1, 1955, fill out this section completely and return to:

Name of Inventory Representative

Title Dept.

SECTION 4 4th of 9 Sections

GROUP

GRADE

RANK IN GROUP

POSSIBLE GRADE 130

SPECIAL NOTE—This section to be filled out by the person in responsible charge of Traffic Engineering. THIS FORM IS FOR CITIES WITH LESS THAN 50,000 POPULATION ONLY.

Fig. 1
Portion of the first page of the Traffic Engineering Section of the Annual Inventory of Traffic Safety Activities.

Over a period of years many of these functional divisions have been taken over by the associations in their fields. But it was not until 1948 that the ITE came into the picture. And it was not until 1955 that the ITE name actually appeared on the forms.

The Traffic Engineering Inventory is one hundred percent a program of the Institute of Traffic Engineers, supervised by Committee 1-F of the ITE Technical Council. The inventory forms are prepared by this Committee and the judging of award winners is done by a board of judges appointed by the ITE.

The National Safety Council serves as a collection agency which mails out the forms, collects the information and does the tremendously detailed job of screening the figures according to criteria set up by the Institute. It also puts the weight of its organization behind the program and applies its field force to assist in getting field information and arranging for effective presentation of anlyasis to cities and states.

Traffic engineers now have a professional society and a measuring procedure to give information on what has been accomplished, where the profession now stands and what lies ahead. At present traffic engineering measurements are being obtained from 48 states and 1,143 cities.

Significance of Measurement

The significant point is that some form of measurement has been established. The fact that a procedure had been set up for measuring is far more significant than the degree of perfection achieved by the measuring of any given year or stage of development.

A great deal of credit is due local officials who have provided the information on the inventory forms. Filling out a questionnaire is never any fun, and a lot of hard work by

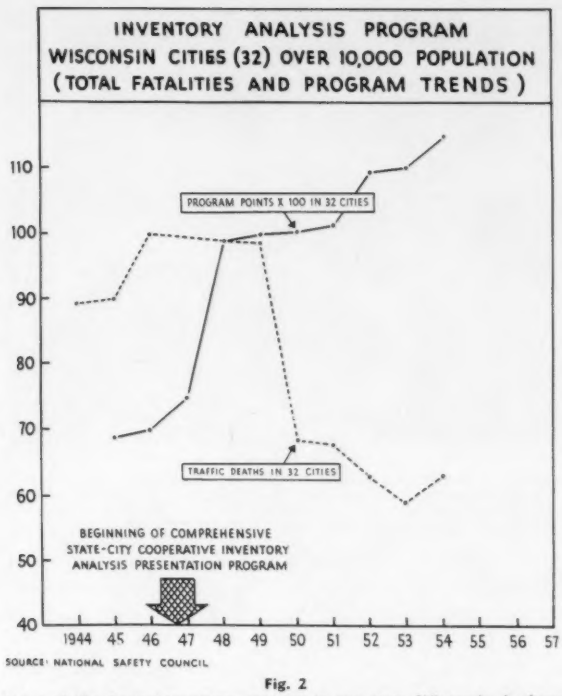


Fig. 2

Value of the Annual Inventory program in one state, Wisconsin, is shown on this graph. Using 32 cities over 10,000 population, this analysis shows that traffic fatalities took a sharp drop as the traffic safety programs improved, as measured by the Annual Inventory.

local officials has made the over-all program a success. Few indeed are those who fail to provide the information or try to sluff it off as unimportant.

No administrator can successfully run an organization without having the facts constantly in front of him. The growth of traffic engineering offices from a one-man outfit run out of a hat as an office and using notes on the back of an envelope for records can be measured to a considerable extent by the factual information available and the quality of the running inventory which is available.

The original "traffic survey" which reached a high level of popularity in the late 1920's was a sound engineering attempt to measure where things stood and to serve as a basis for recommendations as to what should be done. The traffic engineering inventory is a *continuous administrative survey of where things stand,* what progress has been made and what needs to be done. Without such information no orderly progress can be made.

What Are We Trying to Measure?

Inventory, analysis and recommendations are all aimed at traffic improvement through the engineering attack covering both accidents and congestion. The major categories covered by the inventory are as follows:

(1) *The Traffic Engineering Organization and Administration:* Is the traffic engineering unit set up properly by law with clearly defined authority and responsibility? Does it have qualified personnel and a training program? Does it have an adequate budget representing a deserving slice of the total city budget (or state)? Is it doing a sound traffic survey, planning, programming, project development and traffic engineering job? Is it properly maintaining its facilities? In the long run we need to do a much better job in this area. Hard hitting administration is needed just as much as technical improvement. In so many instances the problem is not to find out what to do but how to get it done.

(2) *Traffic Planning:* This is one of the broader aspects of traffic engineering. It undertakes to measure how well we are looking ahead. What surveys are being made? What new roadway systems are planned? In many ways this is a part of the still broader field of what used to be emphasized as city planning or urban planning.

(3) *Basic Roadway Improvement:* This covers major roadway items as they affect movement. New divided roadways, grade separations and new thoroughfares represent a major capital investment.

(4) *Traffic Regulations:* Through streets, one-way streets, prohibited left and right turns—all have a major effect on movement.

(5) *Channelization:* The control of traffic maneuvers by physical arrangements is another major engineering attack.

(6) *Signs, Signals, Markings:* These are the "bread and butter" detailed mechanics of traffic engineering.

(7) *Street Lighting and Reflectorization:* These get at the special problem of movement at night.

(8) *Parking:* Prohibition, loading zones, parking meters, off-street parking lots and garages, requirements for additional "built-in" parking for new buildings all have a tremendous effect on the usefulness of free wheel transportation to business districts.

Recent Major Changes in Form

The last few years have seen some major items added to the information requested on the inventory forms. The following points are among the more important ones:

Professional Standing: This new item calls for information on the professional standing of the person carrying out the traffic engineering function. It is important to know if he is a member of various recognized professional groups as well as whether he is a registered engineer. In the long run it will be important to know if such people have had any training. These things are measures of high professional standing. The mere listing of them will encourage professional improvement.

General Administration: The questions on administration were generally expanded to give more information. As traffic engineering departments grow in size their administration problems grow. It becomes much more important to get more facts because a weakness in administration will now hurt a great deal more.

Traffic Engineering Improvements Planned for the Future: The programming or planning side of traffic engineering has in many areas lagged behind the strictly technical aspects. The calling for information in this area will serve to stimulate the planning and programming for the future. If we are to meet the needs of the future from the viewpoint of traffic engineering then we will have to begin to develop, lay out, and print long range traffic engineering plans.

How Much Money Was Budgeted—And Spent: This information tends to build up the administration side of traffic engineering. Getting things done takes a lot of money so it is high time the profession learns a lot more about budgets. In the case of Highway Departments it is important to know what percent of the total Highway Department budget was spent exclusively for movement—for traffic engineering, compared to maintenance and construction. The sum total of state and city traffic engineering budgets will give

us for the first time some economic measure of the traffic engineering function.

Some idea of the magnitude of the national traffic engineering operations can be obtained from the traffic engineering expenditure figures shown for the first time in the 1954 inventory forms.

(1) 45 states reported *total* expenditures of $63,795,000.00

(2) 34 states showed expenditures for a signal program of $6,939,000.00

(3) 45 states showed expenditures for a sign program of $15,765,000.00

(4) 44 states showed expenditures for pavement markings of $13,084,000.00

(5) 41 states showed expenditures for salary and expense of $21,366,000.00

(6) 27 states showed expenditures for "miscellaneous" of $10,134,000.00

NOTE: Some reports included salaries in program expenditures and also listed them as salaries. This makes the total of the break down items (2) through (6) exceed item (1).

(7) 17 cities over 500,000 population reported a total expenditure of $14,356,906.00.

The state figures and the 17 big city figures total $78,151,906.00. On the face of it the real total must run a great deal over $100,000,000.00 a year. Traffic Engineering is big business and increasing traffic volumes will force it to expand rapidly. The inventory represents the only way to keep track of its growth.

Items for Future Consideration

There are a host of additional items which may be nominated for measurement in the years ahead. The samples listed below should be adequate proof that much yet remains to be inventoried:

(1) *Rate of Movement:* We do not have basic data on central business districts as to how low the common speed gets during normal rush hours. A city with a lot of blocks with speeds 5 to 10 miles per hour is not as congestion free as one with no blocks as low as 10 miles per hour.

(2) *Length of Bus Stops:* Obviously if the bus stops are not long enough for a bus driver to get into and out of easily then part of the bus will stick out into the moving lane and block traffic.

(3) *Length of No Parking Zones Back from Corner:* Wherever there is a special demand for left turns or right turns there is a special demand for opening up an additional lane at the intersection by prohibiting parking.

(4) *Loading Zones at Curb for Trucks:* A great deal of merchandise must still be delivered to stores over the sidewalk for lack of other provisions.

(5) *Control of Delivery Trucks Downtown by Hours:* This usually takes the form of prohibiting delivery at bottleneck locations during peak hours.

(6) *Truck Routes:* Are there specific routes established? Do truckers regularly confer with the traffic engineer on safest and quickest routes?

(7) *Currentness of Master Plan:* How recently has a comprehensive survey been made? Have surveys been translated into specific recommendations? Is the plan brought up to date in keeping with traffic volumes and future forecasts?

Fig. 3
Analysis of information submitted and the preparation of recommendations is a huge task, accomplished by the staff of the National Safety Council. Here, Harry Porter, Jr., Director of the Annual Inventory, and his secretary, Mary Louise Volpe, check some of the reports.

(8) *Flexibility of Signal Equipment:* Has the equipment been modernized or is a lot of it so old that efficient timing schedules are not possible? Can timing be changed several times a day? Do isolated signals change timing? Are vehicle and pedestrian actuated controllers used at all points where they should be?

(9) *Yield Right-of-Way Signs:* Has a law been passed making them legal? Are they standard size, shape, and color? Is this new control device being used to its maximum value?

(10) *Long Range Traffic Eigineering Planning:* Is there a five-year or ten-year plan to complete projects which could not be financed in any one year? Are plans made to head off trouble before it develops, or does the operation merely wait until a bad situation develops and then attack it?

(11) *Insulating Existing Highways by Guard-Rail and Channelization of Roadside Business Entrances:* Is traffic engineering being applied to roadway edge deficiencies brought about by lack of legal control over access? Is the access unlimited or has it been channelized or sealed off by engineering means?

(12) *Special Added Lanes on Hills and Curves for Trucks:* Is there a direct program to relieve this specialized situation by a state-wide plan to clean them up or are these bad situations let ride until a new highway happens to be built?

(13) *Law Observance of Stop Signs and Traffic Signals:* Does the traffic engineer merely try in a general way to bring these up to standard or does he measure their present effectiveness to get at those locations causing the most trouble? Does he have a yardstick to go to the police and ask for more enforcement?

(14) *Special Highway Traffic Safety Improvement Budget Separate from New Projects or General Improvement:* At the state level are the life-saving traffic engineering items being budgeted and scheduled as a *direct safety program* or are they ultimately achieved by accident over a twenty-year period as new highways are built? Is there a separate safety budget and program for applying traffic engineering life saving items to the "old roads" which may be presumed to be replaced by new roads but which in many instances will ultimately carry even more traffic than at the time the new roads were completed?

(15) *How Many Intersections are there Which Need Traffic Signals That Do Not Yet Have Them (rather than just the existing ones that meet the warrants—or do not meet them):* There is a real need to get traffic engineering warrants on a positive basis rather than on a negative basis. We now say in effect "You should not install a signal unless . . ." What we should be doing is saying "When the following conditions prevail there should be a traffic signal installed."

(16) *The Number of Intersections With Heavy Pedestrian Volume Which Do Not Yet Have Exclusive Pedestrian Signals:* There is a great need to accelerate the program of special pedestrian signals. Expanding this item in the inventory would be one way of encouraging it.

(17) *Budget Estimates to Bring all Traffic Engineering Equipment Up to the Standard and to Fully Meet the Needs:* The "Clay Report" pegged highway needs at 101 billion dollars. We don't even know how much money we need for traffic engineering equipment. Certainly finding out how much we need is an essential step in the process of getting it.

(18) *Tabulating Physical Hazards Which Contribute to Accidents:* How many battle-scarred bridge abutments do we have? How many scarred trees and telephone poles are there? What is the mileage of "Slippery When Wet" roadway surfaces? How many miles of sub-standard width lanes are there?

Inventory Comparisons

It must constantly be kept in mind that the facts placed on the inventory are local facts which will always be of greatest value to local people. They are facts which local people must have to operate a local traffic engineering program whether there existed or did not exist a national inventory, analysis, recommendations, contest or award programs.

The facts accumulated on the inventory make it possible to make several different types of valuable comparisons, such as:

(1) *Comparison With Past Record:* The local improvement of any community (or state) over its past performance is still the item of major importance. It is the comparison of this year's inventory with last year's inventory which makes this possible.

(2) *Comparison With Traffic Engineering Standards:* From the inventory figures each community (or state) can see where they stand, relatively, with respect to national technical standards. In the matters covered by such standards at the present time it is important to know whether local items are sub-standard, whether they meet the standard or whether they are better than the standard.

(3) *Comparison With National Recommendations:* In some items where there are not yet technical standards there are national recommendations. It is important to know whether local items meet these.

(4) *Comparison With the Best Practice:* In items not yet covered by technical standards or national recommendations a valuable comparison is how the local item compares with the level of the top thirty percent of the communities (or states) in the country. This is where each city is important to the over-all effort nationwide.

(5) *Comparison With Specific Other Communities (or states) Which Are Reasonable Comparable:* This gets down to direct competition in which the civic pride of one community can be aroused to do a better job than a "sister community." This is the direct contest aspect.

All five of these comparisons have value. All can be used to sell progress in traffic engineering. Gains are to be had by both losers and winners. A community that ranks low has a strong lever to use—"other places are doing it—why can't we do it." The congratulations to a winner strengthen pride and make it easier to stay in the upper brackets.

Inventory Values

Perhaps the greatest value of the inventory is that it gives *greater visibility or emphasis to the traffic engineering function.* Being a separate section of the total inventory sets it apart as an important operation rather than an adjunct to enforcement or an offshoot of a city engineer or city planning office. There is no doubt but that the inventory has in a great many instances been a major influence in creating a traffic engineering department where none existed before.

In the case of existing traffic engineering departments the inventory can be an effective tool in building up the traffic engineering budget and staff to the level where it belongs.

As a printed document the inventory stands as an *authoritative record that is impressive.* It can be pointed to as a formal report made by an outside, unbiased group. This, in many cases, has greater strength than a report by a local traffic engineer who may be falsely accused of trying to build up his own operation.

The inventory also serves as a device to get many facts out in the open and a matter of public record where they can more effectively be put to use. This public record aspect can be important in dispelling any public suspicion that some facts are being hidden—perhaps with political implications.

The inventory assists in obtaining a professional outlook on the problem. It plays up the importance of employing qualified personnel, adequate training, good engineering standards and levels of operation. It encourages good techniques, processes and practices.

As a formal report the inventory serves the engineer by helping non-engineers to get a better picture of traffic engineering. The police, the courts, the school people, the licensing authorities—all essential members of the traffic team—learn more about the field. It serves as a good *sales document* which the engineer can use effectively in discussions with laymen such as representatives of newspapers, radio, television or business, industrial or civic leaders.

Naturally the very inventory form itself encourages the *keeping of good records.* As a result each year fewer people are forced to state "we do not have the information."

The mere placing of questions on the inventory regarding new, good developments encourages additional agencies to speed up the adoption of these developments.

Inventory Analysis

As in all other engineering operations the mere collection of figures is of zero value if they are merely buried in the file. What really counts is their analysis out of which grow specific recommendations for improvement.

In a very real sense the local traffic engineer fills out an inventory for the *exclusive purpose of providing a basis for analysis and recommendations.* The inventory by itself is merely a stepping stone to get to an end product.

Thus it is very important to place the emphasis on the analysis and recommendations. Once good recommendations

Fig. 4
Typical scene as the Inventory Analysis is presented to a local group. In this picture, a field representative of the National Safety Council and the Institute of Traffic Engineers, presents an analysis to the city officials of Janesville, Wisconsin.

are available then the achievement of getting their recommendations put into effect is absolutely certain to produce progress.

Given more staff time a great deal more can be done in spelling out the inventory analysis recommendations, giving them a more precise priority, and suggesting staging programs and projects to achieve them.

Analysis Presentation

A good analysis and set of recommendations, just like a good inventory, are of zero value if they are merely buried in the file. This places great emphasis on the *presentation of the analysis.* With such a valuable tool, the question is how to use it most effectively. There are various stages in the presentation of an inventory analysis which warrant discussions.

The "Official Family": Naturally the analysis must be presented effectively and sold to the so-called "official family" of traffic and government officials. This is the local team that has the authority and responsibility for traffic improvement. Thus arrangements are made to call on them individually and for a meeting of them. In a city they are composed of such people as the mayor, city manager, head of the city council, city engineer, planning engineer, city lighting engineer, police chief, captain of the traffic division, judge, prosecutor, city attorney, high school superintendent, driver education instructor and any other government person whose understanding and support will be needed. In a state there are counterparts for most of these. If budget is a major problem then the finance committee of the city council should be included.

The non-traffic engineering members of the official family must also be sold since it is much harder, for example, to make progress if the local police chief and judge are not sympathetic and will not give their support. The road block of an unsympathetic mayor and city council is too obvious to discuss.

The Public Support Group: With the official family sold on the analysis and recommendations there is then the need of selling them to a public support group. If there is a local safety council or traffic safety organization many of the essential people will already be represented. Of special importance are such people as the owners of local newspapers, radio and television stations, chamber of commerce representatives, heads of local associations of insurance agents, automobile dealers, and key business, industrial and community leaders.

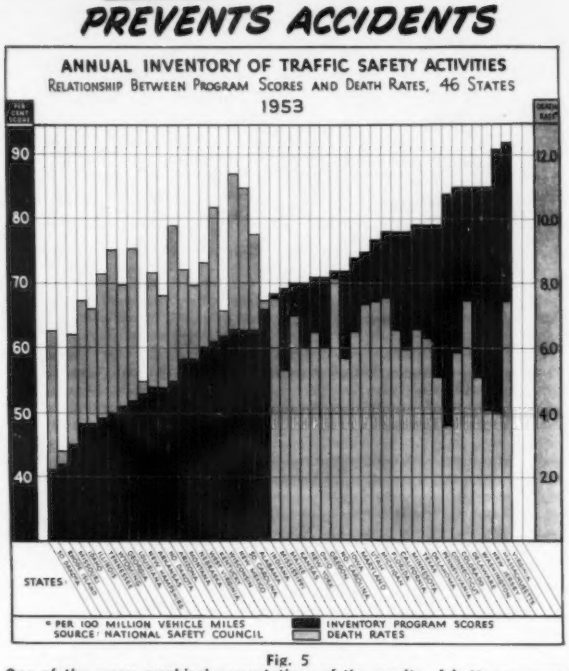


Fig. 5
One of the many graphical presentations of the results of better programs as measured and encouraged by the Annual Inventory.

Follow Up: After the presentation or presentations there still remains the need for a follow-up program. Arrangements, contacts, events, supplementary reports, endorsement meetings and numerous items must be worked out and scheduled.

State Presentation Teams

One of the new and promising developments in the technique of presenting the analysis of city reports took place last year in Michigan.

The Michigan State Safety Commission serves as the state coordinating agency and its Executive Secretary is the Inventory Representative. The Commission designated one of its member departments, the Michigan State Police, to carry the main load on presenting local analysis with some assistance from a staff member of the National Safety Council. These district traffic safety officers have received special training by the staff of the National Safety Council. Mr. Harry Porter, Director of the Annual Inventory of Traffic Safety Activities, actually made the presentation in some ten selected cities. Last year the Commission made arrangements for field representatives of two other Commission member departments to take part in the presentation, the 10 district traffic engineers of the Highway Department and the 21 state examiner supervisors of the Division of Driver and Vehicle Services of the Department of State which has the function of driver licensing.

Thus, at each city presentation there was a state team composed of a police official, an engineering official and a driver license official.

This not only added more talent to the presentation but gave more weight to it. In addition it helped to further improve the day by day working relationship between the local and state engineers and police and between the courts and the driver license agency. Unfortunately the Michigan De-

partment of Public Instruction does not nave a safety staff or field men who could join the team and work with the local school officials. In states where there are such staff a four-man team would be tremendously effective.

Naturally, the members of such teams need specialized training in the program and additional training and re-training programs should be worked out. This has already been done in some cases by the field staff of the National Safety Council.

Another valuable contribution at the state-local presentation program is the development of a special analysis which compares each of the cities within the state. This provides comparisons which can be even more effective than can be some comparisons with cities in other states.

Future Developments

While substantial gains have been made in the inventory form, in the analysis, in the recommendations, and in the presentation there still remains much to be done. Among the more obvious needs are:

(1) A continual study by the ITE Committee of improvements in the form itself. (The fact that there were very few complaints about the last revision and additions is encouraging.)

(2) The development by the ITE Committee of a manual on traffic engineering keyed to the actual numbers on the inventory form. This would make the inventory even more useful in stimulating improved traffic engineering techniques.

(3) The development of a "packaged sales program" on presenting and follow-up selling on the analysis recommendations.

(4) The digging out of the inventory forms a lot of extremely valuable information which could be made available in terms of national figures to show the total status and growth of traffic engineering and all of its component parts. This would take a considerable amount of staff time. But if facts are worth collecting it is certainly worthwhile to squeeze all possible valuable information from them.

(5) A continuing study of evaluating methods. Is there a better way than the 30 percent level? Are there better bases than miles of street, population, registration, vehicle miles of travel, etc.?

Continual measurement of the traffic engineering function and professional gains are certainly one of the important responsibilities of the Institute of Traffic Engineers. In recognizing and accepting this responsibility, the Institute and its members have done much to raise the level of traffic engineering activities in the cities and states of this nation.

Traffic engineers face a very real challenge in the future. So much has been publicized about "Billions for New Highways" that public consciousness is being influenced strongly in the direction of construction rather than movement. The same tremendous increases in traffic volume that make new construction essential certainly require that the type of new construction give maximum safe and rapid movement and that traffic engineering for movement be stepped up on city streets—most of which will be here fifty years from now—and on the "old highways" which will still kill people unless given sound traffic engineering treatment.

"Traffic pressures" in big cities are producing new thoughts on organization and administration. Are we going to have a "Traffic Authority" with "line control" over all traffic agencies? Are we going to have a "Super Traffic Board" with "staff control" over all agencies? And what about "Parking Authorities"?

Is the traffic engineer to widen his scope or is he to be swallowed up or overshadowed by new developments? Are the old mechanical trio of signs, signals, and markings going to be a sort of detailed anchor that will hold him back.

The Inventory is at present one of the few nationwide programs conducted by the Institute. It must reflect the future of traffic engineering.

PITTSBURGH'S PENN-LINCOLN PARKWAY

(Continued from page 449)

In addition, the Fort Duquesne Bridge over the Allegheny River will be built to provide full utilization of the Point Interchange.

Also, it is proposed as a related project to relocate and construct a part of West Carson Street lying south of the Carson Street Interchange.

CONCLUSION

Topography and existing costly development make this project an expensive one to build. However, the benefits to traffic in time savings and operation costs, reduction of accidents, congestion relieved, the improvement in the distribution and movement of traffic resulting from the improvement more than justify the cost.

The foregoing reveals the incorporation of ultra-modern engineering and design features in the interest of public safety and driving comfort, as well as efficient operation. Although maximum utility was paramount in design of the Parkway, its aesthetic appearance is outstanding as an approach to a great metropolis.

Those members of the Institute of Traffic Engineers who will be attending the Annual Meeting in Pittsburgh in October will, without a doubt, use a portion of this Parkway on approaching the City of Pittsburgh from the east or west by automobile or on arriving in Pittsburgh through the Greater Pittsburgh Airport in reaching Convention Headquarters from the airport. It is also planned to further explain the remaining work on this project to the members during the convention with models of the uncompleted sections.

Please Mention

TRAFFIC ENGINEERING

When Writing Advertisers

The Capacity of Urban Streets and Intersections

By K. V. M. Koefoed

Chief Engineer, City Engineer's Department, Copenhagen

This paper originally appeared in the 1954 Autumn issue of the International Road Safety and Traffic Review, published quarterly in English and French, by the World Touring and Automobile Organization of London.—EDITOR.

Introduction

THE STATEMENTS MADE in this paper are based partly on existing literature concerning this subject, partly on theoretical considerations, and partly on observations and studies of the street traffic in Copenhagen.

Traffic Capacity

Several definitions have been given of the term traffic capacity. In this paper, which treats of urban traffic exclusively, this term is used only in the sense of "the greatest amount of traffic which can pass a section of a street in one hour without causing perceptible traffic difficulties."

Factors Affecting Traffic Capacity

The main factor determining the capacity of an urban street is the capacity of the intersections, which again is determined by the amount of crossing or turning traffic, by the way in which the traffic is regulated, and by the width of the carriageway. Besides, several other factors, such as the composition of the traffic, the dimensions of the individual vehicles and their speed and acceleration qualities, are of great importance.

In the following an attempt has been made to offer a method of estimating the capacity of street intersections, consideration being given to all the above factors.

Capacity of Intersections Controlled by Light Signals

The following refers mainly to fixed-time signals, but, broadly speaking, it will also apply to vehicle-actuated signals, as these generally operate in the same way as fixed-time signals when the traffic density approaches the capacity limit.

The capacity of each lane at the entry to a signal-controlled intersection, Cl, may be expressed as

$$Cl = u.Cq.$$

the u indicating the degree of utilization of the intersection for traffic in the given direction and Cq the number of vehicles which, after starting from a stationary queue, would be able to pass a point of the street in one lane during an hour. The degree of utilization is calculated as the ratio of the traffic passing the stop line during a "green" interval to that which might have passed during the time-cycle if the signal had been green all the time. If the length of the "green" interval is g seconds and that of the time-cycle c seconds, the approximate value of u may be calculated as $\frac{g-4}{c}$, when g, as is usual, is not less than 15 seconds. The 4 seconds represent the time lost through the starting and accelerating of the first vehicles in the queue.

Cq is considerably smaller than the maximum capacity of a lane. In traffic consisting exclusively of passenger cars, the maximum value of Cq will be about 1,500 cars per lane per hour. It should be noted that Cq is not equivalent to the "lane capacity per hour of green" referred to in the American "Highway Capacity Manual."

The actual value of Cq depends on the size of the cars, their speed, and their acceleration qualities. It is difficult to determine Cq for a very mixed traffic because the big vehicles with low acceleration take up more space lengthwise than the others, and because—independently of that—the slower cars delay the discharge of the queue as a whole, and this applies whether it contains few or many of these.

A method for the calculation of the capacity, applicable to mixed traffic, therefore requires that the individual vehicles are given a "weight" corresponding to the space they occupy in the moving line of cars, and that the values of Cq are differentiated according to the various speeds at which the line of vehicles can move.

As a unit for the space requirements the space occupied by an ordinary passenger car is used. In the following this unit is referred to as p.c.u. In Table I below is given a synopsis of the space requirements of different vehicles, expressed in p.c.u.'s.

TABLE I

Space requirements in a moving queue for different types of vehicles. Space for one passenger car equals 1 p.c.u.

Type of Vehicle	*p.c.u.*
Passenger car	1.0
Motor cycle with sidecar	0.9
Motor cycle without sidecar	0.6
Motor-assisted pedal-cycle	0.4
Light lorry or van	1.0
Medium lorry, 3-4 ton load	1.5
Lorry with trailer	2.0
Commercial vehicles, average	1.3
Motor or trolley bus	1.6
Trolley-train (2 cars)	2.2
Tram-train (2 cars)	3.5
Transport tricycle	0.6
Horse drawn vehicle	1.5
Handcart	1.2
Pedal cycles, when up to 1,000 per hour, each	0.2
Pedal cycles, when more than 1,000 per hour: 1,000 = 200 units, additional numbers each	0.15

The figures of this table, which have been arrived at partly through theoretical considerations, partly through observations in the field, do not on the whole differ much from those found by others through similar investigations.

When fixing Cq for different traffic compositions, it must be taken into account that at light-controlled intersections it is only a matter of discharging relatively short queues, generally consisting of only 5-12 cars.

The composition of these queues may be highly varied, so that the quantity of Cq will actually differ from one "green" interval to the next.

By calculating the probability of the different compositions it is possible, however, to compute an average value of Cq for the traffic composition under consideration. Further, it must be taken into account that the influx of traffic at an intersection is not constant, so that even in peak hours intervals may occur in which the capacity cannot be fully exploited.

The values of *Cq* as stated in Table II below are the result of such a calculation:

TABLE II

Cq in terms of passenger car units by different compositions of traffic (excluding vehicles moving slower than pedal cycles). Lane width 3.0 metres.

Traffic composition	*Cq*
10% heavy and slow traffic. No cycles	1,350 p.c.u.
25% heavy and slow traffic. No cycles	1,300 p.c.u.
50% and more of heavy and slow traffic. No cycles	1,250 p.c.u.
Vehicular traffic mixed with numerous cycles	1,200 p.c.u.

The following applies to certain special components of traffic:

Tramcars, which have stopping places without loading refuges immediately at the entry to the intersection, will cause vehicular traffic to stop to allow passengers to cross the carriageway. This involves a considerable reduction of the capacity. A calculation has shown that an allowance of 8 p.c.u.'s must be made when computing the green time requirement of a tram-train having a stop of 20 seconds immediately before the entry to a signal-controlled intersection. (The figure 3.5 p.c.u.'s in Table I only applies to tram-trains which do not stop near the intersection.)

Buses having stops immediately at the entrance to an intersection will block a lane as long as they stand, unless a special turn-out lane has been provided. If not, 3.2 p.c.u.'s must be allowed for them.

Very slow-moving vehicles, such as horse-drawn carts, handcarts, and transport tricycles, will likewise reduce the capacity beyond that which is involved by the value allowed to them in Table I. As these vehicles will mostly appear only in small numbers, it will, instead of calculating special values for *Cq,* generally be sufficiently correct to use the *Cq* values of Table II counting:

1 horse-drawn cart = 5.0 p.c.u.'s
1 hand-cart = 4.0 p.c.u.'s
1 transport tricycle = 1.5 p.c.u.'s

due allowance having then been made for their space requirements as well as their delaying effect on the other traffic.

By means of the figures in Tables I and II the capacity per lane can be computed for any intersection, provided that the timing of the signal period is known. The width of a lane is taken to be 3.0 metres.

In this calculation it is further assumed that the approaches to the intersection are fairly free from stationary vehicles, and that the turning traffic is not of considerable magnitude.

It is a fact that the turning traffic, especially the left-turning, may exercise a considerable influence on the capacity.

It is difficult, however, to lay down general rules for the extent of that influence, as it will depend, *inter alia* on the space conditions in the intersection. In many cases it is mostly the left-turning vehicles from the oncoming traffic which create the difficulties for a given stream of traffic.

In Table III are shown some actual peak hour traffic figures from a number of intersections in Copenhagen, and also the capacities as calculated by the method indicated above.

It will be seen that no traffic difficulties of any consequence have occurred in the streets where the density of traffic has not been above the calculated capacity.

It is remarkable that a calculation made by the methods indicated in the "Highway Capacity Manual" has given capacity values considerably lower than those given in Table III.

The capacity of *cycle-tracks* can be calculated in a way similar to the one used for carriageways. *Cq* will here be 2,250 cyclists per "cycle track lane," the width of which is 0.9 m. It is easier though, and just as accurate, to figure 2,500 cycles per metre of width.

The Capacity of Roundabouts

The total capacity of a roundabout may vary widely according to the way in which the traffic is distributed among the contributory streets, because it is the capacity of that section of the circular carriageway which carries the densest traffic that decides the capacity of the whole system.

The factors determining the capacity of this section are the width of the carriageway, the radius of the central island, and the weaving angle. These three factors are to a certain degree interdependent.

The character of the traffic is also of importance since it affects not only the capacity per lane but also the lane width. A great lane width is desirable especially when a substantial part of the traffic consists of buses and heavy lorries.

Generally speaking, the shape of the central island should be circular with a radius of at least 20 m. In urban areas, though, it may be necessary at some places to use a smaller radius. Several roundabouts with a radius of little more than 10 m. have been constructed and have functioned fairly satisfactorily.

The number of lanes should preferably be three, and the lane width from 3.3-4.0 m. according to the composition of

TABLE III

Peak hour traffic in one direction at the entry to some light signalled intersections in Copenhagen

Observation year	*Available carriageway width m*	*Degree of utilization (u)*	*Turning traffic*		*v.p.h. excluding pedal cycles*	*Actual traffic per hour*		*Estimated capacity (p.c.u.'s)*	*Traffic difficulties*
			Right percent	*Left percent*		*Pedal cycles*	*Total in p.c.u.'s*		
1935	3.0	0.35	not observed		435	0	452	472	none
1935	5.9	0.51	not observed		441	3012	990	1210	none
1938	5.9	0.45	10	14	255	3786	1028	1070	slight
1938	3.15	0.38	not observed		171	1420	440	480	none
1938	6.5	0.45	not observed		814	0	1096	1210	none
1947	6.0	0.35	27	25	560	2907	1064	840	considerable
1953	9.3	0.41	23	10	1202	0	1157	1570	none
1953	6.5	0.38	10	8	748	1824	1064	990	some
1954	5.9	0.52	6	4	947	2901	1445	1230	none
1954	6.0	0.55	3	4	1371	0	1426	1420	none
1954	5.8	0.50	4	6	1367	0	1411	1280	moderate

Hawkins Traffic SAFETI-BAR

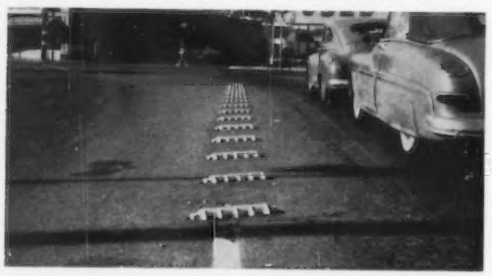
A JIGGLE-BAR THAT JIGGLES AND CONTROLS

Concepts evolving from use of jiggle-bars are often misunderstood. Barriers, damaging obstacles and pre-cast curbs which throw vehicles out of control have no engineering factors. A true jiggle-bar CONTROLS, GUIDES. PROTECTS and is a step TOWARD SAFETY.
PROTECTING a TRAFFIC SIGN with DEATH is not an Engineering feat.

Write for Illustrated Circular

MANY USES:—"Safeti-Bars" are your "best bet" for protecting safety islands, preventing dangerous left turns, centerlining narrow bridges and tunnels, marking and channelizing parking lots, etc.

EASILY INSTALLED: — With each "Safeti-Bar," securing pins and adhesive mastic are supplied. A special reflective coating is available at slight extra cost.



HAWKINS - HAWKINS COMPANY

Traffic Safety Devices

1255 EASTSHORE HIGHWAY BERKELEY 10, CALIFORNIA

the traffic and the radius of the central island. Two lanes can hardly cope with the peak hour traffic in cities, and in any case four lanes or more will require a great radius to function satisfactorily. The weaving angle should not exceed 30°.

Great problems arise from tram and bicycle traffic in roundabouts.

In Copenhagen the tramway tracks are always carried straight through the central island, and thus the trams do not take part in the rotation. This involves, of course, some reduction of the capacity. The degree of this reduction depends on the number of tramcars per hour, and also largely on the distribution of traffic in the roundabout. The drawbacks of this arrangement are not always very conspicuous.

The bicycle traffic, on the other hand, may cause considerable difficulties, as the traffic regulations allow bicycles to use the outer right hand lane only.

This does ensure that bicycles are not mixed with the weaving vehicular traffic, and thereby some delays and elements of danger are avoided, but at the same time considerable difficulties are caused for those vehicles which have to cross the flow of cyclists when leaving the roundabout. Just the same problems arise if separate cycle tracks have been provided along the circumference of the roundabout.

In order to allow a comparison to be made between the capacities of the different roundabouts, it has been attempted here, as for the signal-controlled intersections, to express in different numerical values the effects of the various vehicles with regard to capacity, the unit being the passenger car. For this purpose the figures of Table I have been used, except that buses are counted as the equivalent of 2.3 passenger cars each, and commercial vehicles on an average 1.6 passenger cars each.

In Table IV below are set out the results of traffic surveys in five roundabouts in Copenhagen, and the computed equivalents in terms of passenger car units. All these roundabouts

TABLE IV

Peak hour traffic through that cross section of the circumferential carriageway which has the maximum traffic density, as observed in five roundabouts in Copenhagen, all crossed by tram tracks.

Radius of central island m.	*Carriageway width m.*	*Weaving angle*	*Maximum rate of flow on carriageway (v.p.h.)*				*Traffic difficulties*
			Vehicles excluding pedal cycles	*Pedal cycles*	*Total in p.c.u.'s*		
					Total	*Per metre of width*	
20.0	7.5*	19°	1140	3700	1880	252	considerable
25.0	12.0	32°	1800	2660	2254	188	none
15.0	11.0	28°	c.700	c.6000	1650	150	some
11.8	11.3	35°	1265	3150	1685	149	some
13.0	11.0	32°	1480	7600	2700	245	considerable

*Estimated effective width. Total width is 9.0 m.

are traversed by tramway tracks, and the bicycle traffic is very considerable. The traffic density has been computed per metre width of carriageway because the lane width in roundabouts is to be considered only as a design factor, of little or no importance with regard to capacity calculations.

The results seem to show a certain system, but the material is too small to allow general conclusions to be reached.

It may be difficult to lay down general rules whether roundabouts or light signals should be preferred in given cases. In general it may be said, however, that roundabouts are preferable when there is much turning traffic, especially left-turning, and that a roundabout will normally have a somewhat greater capacity than a signal-controlled intersection. On the other hand the layout of a roundabout will be much more expensive.

Concluding Remarks

The statements above concern the capacity of the intersections only. This, however, generally determines the capacity of urban streets, as the traffic which can pass the intersections will normally only be of a magnitude which allows it to pass easily through the connecting streets.

Sometimes, however, parked cars may cause traffic difficulties outside the intersections, especially in streets with tramcars. It is difficult, however, to make these conditions the subject of calculations.

TRAFFIC NEWS

Yale Bureau Graduates 34

The names of thirty-four men who completed the course in June of this year in Highway Traffic by Yale University's Committee on Transportation were announced by Fred W. Hurd, Director of the Yale Bureau of Highway Traffic.

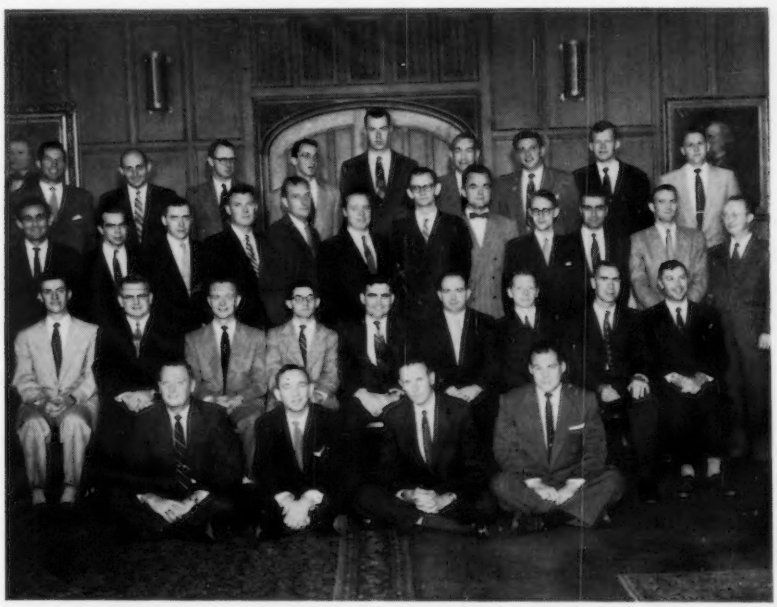
These graduates join 330 engineers in the field who have completed the one-year course offered to graduate engineers interested in a professional career in highway traffic.

The Bureau of Highway Traffic course covers such matters as the basic theory and practice of traffic regulation, design, planning and administration, and also deals with problems of safety.

Many of the new graduates have returned to former positions. Thirteen of them have positions in the urban traffic engineering offices in Baltimore, Maryland; Berkeley, California; Chicago, Illinois; Hamilton, Ohio; Houston, Texas; Philadelphia, Pennsylvania; Rockville, Maryland; Tacoma, Washington; White Plains, New York; and Wichita Falls, Texas.

Nine graduates have gone into planning and traffic engineering divisions of State Highway Departments in Arkansas, Delaware, Montana, Rhode Island, Virginia, and West Virginia. Seven went to positions in the field of highway traffic in such countries as Australia, Denmark, Finland, Germany, Lebanon, Sweden, and Switzerland.

Of the remaining graduates, one has entered organizational work, three have joined consulting firms, and one will return to the Army Transportation Corps.



The thirty-four men who completed the course in Highway Traffic by Yale University are pictured above.

First row (left to right): James R. Doughty, City of Hamilton, Ohio; Stephen George, California Division of Highways; Roy E. Oakes, City of Berkeley, California; Earl C. Williams, City of Wichita Falls, Texas.

Second row (left to right): Karl Noerr, Virginia State Highway Department; Vealess F. Hudspeth, Arkansas Highway Department; Marvin W. Lotspeich, City of Tacoma, Washington; James T. Azar, Rhode Island State Highway Department; Robert A. Kizer, U. S. Army; William R. Carrow, Delaware State Highway Department; Gunner E. Kullstrom, Bromma, Sweden; Milton H. Heywood, City of Baltimore, Maryland; Edward L. Smith, National Safety Council.

Third row (left to right): Harvey E. Hawkins, City of Houston, Texas; Roy A. Flynt, City of White Plains, New York; John I. Manning, City of Philadelphia, Pennsylvania; Louis E. Keefer, West Virginia State Highway Department; Roe P. Hendrick, Campbell Associates, Boston, Massachusetts; Kaarlo Leinonen, Helsinki, Finland; Gunnar E. K. Jensen, Odense, Denmark; H. Dale Humphrey, City of Chicago, Illinois; Martin C. Rotach, Zurich, Switzerland; Kamal S. Khuri, Alay, Republic of Lebanon; John M. Scruggs, City of Philadelphia, Pennsylvania; Eugene J. Clifford, Montgomery County, Maryland.

Fourth row (left to right): Siegfried Giesa, Hannover, Germany; James E. Watt, Bruce Campbell & Associates, Boston, Massachusetts; John M. Bayley, Melbourne, Australia; David K. Witheford, Delaware State Highway Department; William D. Flye, City of White Plains, New York; Maurice Richey, Montana State Highway Department; Paul C. Petrillo, Ramp Buildings Corporation, New York City; Paul L. Strel, Rhode Island State Highway Department; Robert A. Hubbard, Virginia State Highway Department.

Attention Shutterbugs! Traffic Photo Contest

The contest is open to anyone who desires to submit pictures. All batches of pictures submitted, however, must be accompanied by an entry blank, printed only in TRAFFIC ENGINEERING. The contest opens September 1, 1955, and closes January 1, 1956.

Any number of pictures may be submitted. No entry fee is required. Pictures may be in black and white or in color. If black and white photos are submitted preferred sizes are 5x7 or larger.

The subject matter is limited to traffic, traffic engineering and associated subjects. Unusual and interesting pictures are desired which are suitable for front covers or frontispieces for TRAFFIC ENGINEERING Magazine. There must be a suitable caption which describes the location and particular circumstances of the photograph on the back of each.

Prints should be submitted unmounted and may be either glossy or matte. Name and address should be printed on the back of all prints or attached thereto and on all mounts of color transparencies. Unsuccessful pictures will be returned only if they are accompanied by a self-addressed stamped envelope.

Prize winning pictures including all reproduction and promotional rights become the exclusive property of TRAFFIC ENGINEERING. The contest will be judged by a committee of associate Editors of the magazine. Address all entries to:

Contest Editors
Traffic Engineering Magazine
211 Strathcona Hall
Yale University, New Haven, Conn.

Winners will be announced in the February issue of TRAFFIC ENGINEERING. First prize is a $25 (maturity value) U. S. Savings Bond. Two second prizes of $10 each and three prizes of $5 each will be awarded. All other usable entries will receive a $3 award upon publication. The decision of the judges is final and cannot be changed. Traffic Engineering assumes no responsibility for loss of or damage to contest entries. Each batch of contest photos must have an accompanying entry blank. (See entry blank on page 463.)

Summer Graduate Program In Highway Engineering

A class of 27 college engineering instructors from 23 states and two foreign countries is studying advanced highway engineering this summer with the Institute of Transportation and Traffic Engineering of the University of California, Berkeley.

Street and highway construction is accelerating all over the country and is expected to continue to increase in the foreseeable future. The shortage will be even more acute when Federal legislation for better interstate highways is adopted. The summer instruction program at Berkeley is designed to aid other colleges and universities in expanding their teaching of highway engineering so that enough men can be trained to fill the many jobs now open in the highway profession.

The program will last eight weeks. Enrollment was limited to men now teaching or scheduled to teach highway engineering, and the course is designed to improve all phases of teaching in the highway field. The regularly enrolled students have each received $650 grants from the Automotive Safety Foundation or the Highway Research Board of the National Academy of Sciences.

The students are taking two graduate-credit courses, conducted by members of the ITTE staff. Donald S. Berry, assistant director of the Institute, is teaching "Traffic Engineering: Analyses"; and Ralph A. Moyer teaches "Highway Planning and Economics."

Besides the regular courses, a series of seminars is covering other phases of transportation engineering, with emphasis on teaching methods. At least one such seminar is being held each week by experts from all parts of the country. These include Joseph Barnett and Robley Winfrey of the U. S. Bureau of Public Roads, J. C. Womack, J. C. Young, and F. M. Reynolds of the California Division of Highways; Alan Voorhees of the Automotive Safety Foundation; Professor C. H. Oglesby, Stanford University; F. Houston Wynn, Associate of Wilbur Smith and Associates, New Haven, Conn.; and K. B. Woods, Head, School of Civil Engineering, Purdue University. Besides these men a number of other members of the ITTE staff will speak either during the special seminar series or at informal luncheons.

The class will also take two field trips. A one-day trip to Sacramento is designed to study some of California's techniques in highway planning as well as the municipal off-street parking in that city. A three-day trip to Los Angeles will give the class a chance to see California's two main North-South highways, to analyze the metropolitan Los Angeles freeway system, and to meet the ITTE staff at the University of California at Los Angeles.

Pictured above are students and faculty of the graduate program in highway engineering being offered for college instructors this summer by the Institute of Transportation and Traffic Engineering of the University of California, Berkeley. From left to right, bottom row: Clyde E. Lee, Mississippi State College; Michael Lash, Jr., U. S. Bureau of Public Roads, Special Student; Charles Pinnell, Texas Technological College; Professor Donald S. Berry, ITTE, University of California; Professor Ralph A. Moyer, ITTE, University of California; Leo J. Goldsmith, University of Denver; Bruce G. Finke, University of Washington; Walter H. Zimpfer, University of Florida. Middle row: Robert S. Turner, State College of Washington; Marvin C. May, University of New Mexico; Jack E. Stephens, University of Connecticut; Lawrence K. Sieck, Iowa State College; Robert H. Pearson, Drexel Institute of Technology; Thurmul F. McMahon, University of Kansas; Loren R. Heiple, University of Arkansas; Alfred C. Scheer, South Dakota School of Mines and Technology; Howard E. Irby, University of Missouri. Top row: B. Austin Barry, Manhattan College; Theodor W. Thomas, University of Minnesota; Arthur L. Straub, University of Virginia; David K. Blythe, University of Kentucky; Kenneth D. Cummins, University of Detroit; Myron M. Jacobs, University of Santa Clara; Preston D. Linford, University of Utah; George R. Ferguson, III, Louisana State University; Herbert F. Langdon, Chico State College; David J. Hall, University of Arizona; Robert T. Howe, University of Cincinnati; T. E. H. Williams, University of Durham, England, Special Student. Missing Ahmad F. Umar, Technical University of Istanbul, Turkey, Special Student.

Economic Study of Effect On Rolla by U. S. 66 Relocation

The Missouri State Highway Commission has begun a study at Rolla, Missouri in which it will seek to determine the economic effect on that community when through traffic is routed around the congested urban area. This is the first of such studies to be conducted by the Highway Commission.

Controlling the access and relocating major routes in urban areas in order to reduce traffic congestion has become imperative in recent years, and the purpose of this study is to determine the economic impact of such action upon business.

The Missouri study is being directed by the Division of Highway Planning, headed by S. M. Rudder. P. G. Parrish of that division is directing the project with Floyd E. Mattlage, statistician, doing most of the personal interviewing work.

Record $3.6 Billion Paid to States By Highway Users in 1954

The nation's highway users paid a record $3,639,899,000 in state highway use taxes last year, according to tables recently released by the U. S. Bureau of Public Roads. Motor fuel taxes accounted for $2,305,759,000; motor vehicle taxes, $1,251,313,000; and motor carrier taxes $82,827,000.

The 1954 total is 6.89 percent above the $3,405,210,000 collected from these sources in 1953, with motor carrier receipts showing the greatest increase — 16.8 percent.

The continued accelerated pace of motor vehicle registrations, a good level of use and some increased tax rates all helped contribute to the highest total revenues yet collected by the states from the users of the highways.

New Appointments . . .

Voorhees Named Director Pittsburgh C. of C.

Mr. Sherman P. Voorhees (Affil. Mem., ITE), recently became executive director of the Pittsburgh, Pennsylvania Chamber of Commerce. Mr. Voorhees, a specialist in municipal affairs, succeeded Mr. Donald J. Howard, who retired after 26 years with that organization, during which time an envious record of accomplishment was built up. Probably the most notable achievement of the Chamber was the elimination of smoke in the city which had been dubbed the Smoky City.

Sherman P. Voorhees

Voorhees was formerly a resident of Springfield, Massachusetts, where he had held the post of executive director of Future Springfield, Inc. since 1945 when that municipal research organization was founded.

Mr. Voorhees attended St. John's Military School, Phillips-Andover Academy and Columbia University. He was one of the founders of national glider meets at Elmira and also a founder and first manager of the Elmira Airport.

Later he became advertising manager of Natural History magazine, published by the American Museum of Natural History at New York City, and immediately prior to entering the Army he was eastern manager of the Army - Navy Journal.

On graduation from Officer Training School of the Army Air Force at Miami, Fla., in 1942, Mr. Voorhees was commissioned a captain. Following his promotion to major, he was assigned to the 4th Air Force at San Francisco and reassigned to the San Diego Fighter Wing. In November, 1943, he was transferred to the Air Technical Service Command at Wright Field, Dayton, O. He went on inactive duty in September, 1945.

Mr. Voorhees came to Future Springfield directly from the Air Force and has been the only director the organization has had in the decade since its inception. In 1949, his services were loaned to the Springfield Chamber of Commerce on a part-time basis, while the Chamber was undergoing a period of transition.

While serving as executive director of Future Springfield, Mr. Voorhees was also acting as general secretary of the Chamber of Commerce, dividing his time between both organizations.

Future Springfield, Inc., was established at the end of World War II as a privately financed bureau of research in municipal government. Its membership includes the city's leading banks, businesses and industrial firms.

Some of the more outstanding accomplishments of Future Springfield under the direction of Mr. Voorhees are: Traffic studies which led to the appointment of a city traffc engineer; an airport study which resulted in the acceptance of Bradley Field as the joint air terminal for the Springfield-Hartford area; a housing study in 1946 which added support to the creation of the Springfield Housing Authority; the building code evaluation study which gave substantial help to the city's Building Code Committee, a study of the City Library Association which received national attention; publication in 1954 of a copyrighted brochure called "Community Inventory," giving pertinent statistics on the Springfield area; an administrative study of the city's Health Department.

Mr. Voorhees has long been active in the association field. He holds membership in several professional societies, including the Government Research Association, National Municipal League and Institute of Traffic Engineers.

Both Mr. and Mrs. Voorhees are looking forward to meeting old friends and making many new ones next October at the Founders' 25th Birthday Meeting of the Institute of Traffic Engineers in Pittsburgh.

Smith Accepts NSC Inventory Post

Edward L. Smith was recently appointed Senior Traffic Engineer with the National Safety Council, to be in charge of the Traffic Engineering section of the Annual Inventory of Traffic Safety Activities. This program is conducted by the Traffic and Transportation Department of the National Safety Council in cooperation with the Technical Council of the Institute of Traffic Engineers.

Edward L. Smith

A native of Lake Geneva, Wisconsin, Smith interrupted his college training for three years to serve in both the European and Pacific theaters with the Corps of Engineers during World War II. Returning to the University of Wisconsin, he received a B.S. degree in civil engineering in 1947.

Following graduation, Smith was employed by the Wisconsin Highway Commission and worked on field projects near Milwaukee. In 1949 he moved to Fort Worth, Texas, and for the next five years worked at various phases of structural engineering. This included bridge design, plan preparation and field welding inspection for the Texas Highway Department. He is a registered professional engineer.

Taking advantage of a tuition scholarship, Smith entered the Yale Bureau of Highway Traffic in 1954 and completed the course of study just prior to joining the National Safety Council staff.

Mr. Smith's hobbies are connected with "anything that moves." He is a boat enthusiast, holds a private pilot license, and combines photography and motoring with a special car mounted camera.

Strictly Business

A New Method of Parking — File-A-Way

Sales and distribution outlets are now being set up nationally by File-A-Way Parking Corporation, 4701 N. W. Front Ave., Portland, Oregon, according to the firm's officers. A 7-tier unit can be inspected in full operation at the manufacturing site.

File-A-Way, the name of which graphically depicts its operation, claims to show a lower construction cost per car unit than any other mechanical system. It is designed to utilize small land parcels, particularly in congested downtown areas, to make them profitable by parking cars above or below street level. Installations are sold outright; there are no royalties or lease encumbrances.

This new system offers nine basic ground plans and can be constructed in any number of tiers up to 12. It is pointed out, however, that each File-A-Way installation is planned individually and engineered specifically to provide the most efficient type of operation for any given location and site and its relation to the traffic plan. Furthermore, File-A-Way engineers will coordinate the parking system's designs with plans for new buildings such as apartment houses, hotels, office buildings, industrial plants, supermarkets and the like.

The File-A-Way structure is expandable. Additional tiers may be added as the demand warrants. Likewise, a File-A-Way parking unit can be dismantled at the expiration of ground lease, or other reason, and re-erected at another site if desired.

The operation of the File-A-Way Parking System is patterned after standard semi-automatic elevators and recognized as being the finest available for lift operation. Electrically controlled, File-A-Way is constructed of standard parts which have been service-tested and are now in use in heavy industry. They are guaranteed by the manufacturers, Gunderson Bros. Engineering Corporation, Portland, Oregon. A File-A-Way servicing plan is in effect throughout the United States and the equipment may be quickly serviced and easily replaced if necessary. All component parts are fully warranted.

This modern parking system meets all building and safety codes, being built to A.S.T.M., A.I.S.C and A.S.E. specifications. Fast, smooth silent operation is claimed for File-A-Way. Push-button control is used, with one operator, or two at the most. Because no one enters the automobile after a customer locks his own car, theft is not probable, and there can be no greast or dirt on the car seats or steering wheel. Safety factors minimize possible damage. As a result, insurance rates for theft, damage and public safety are substantially reduced with File-A-Way. Full insurance coverage, through File-A-Way, is available.

A colorful, detailed brochure, "FILE-A-WAY . . . Realistic Relief for Congested Traffic Areas," is just off the press. It explains the principal operating parts of a File-A-Way installation and how the system works. It gives comparative facts and figures for all types of parking. Interested persons may have one or more copies by writing or wiring. No obligation.

File-A-Way Parking Corporation
P. O. Box 3616, Portland 8, Oregon

A New Safe Passage Installation By Remote Control of Traffic Lights

All traffic at the intersection of Florence and Western Avenues can now be stopped by remote control to assure safe passage of three vehicles from Los Angeles City Fire Station No. 66, Florence Avenue, on emergency calls. The new "safe passage" installation is an electronics system developed by North American Aviation for remote control of traffic lights.

In a public demonstration today, emergency vehicles from the station several times cleared traffic out of the Florence and Western intersection by remotely snapping the green signal lights immediately through amber to red.

Radio transmitters mounted on the vehicles sent out directional signals which were picked up by receivers on the traffic lights, changing them to red. With the intersection thus cleared of normal traffic, the emergency vehicles proceeded safely through.

NATECS (for North American Traffic Emergency Control System) was developed by the company in consultation with city traffic engineers. The Florence and Western installation will provide operational experience under actual emergency conditions. The city will operate the equipment under a Federal Communications Commission approved license.

To avoid the possibility of two emergency vehicles colliding at an intersection, an interrogator light is mounted on the signal standard and incorporated in the system. The interrogator light serves to notify emergency vehicle drivers that the intersection is NATECS controlled. While receiving a signal from only one transmitter, the auxiliary light glows steadily, signifying NATECS is in control and the system is operating properly. Upon receiving another signal from a second vehicle, the steady glow changes to rapid blinking to warn each driver of the other's approach.

An engineering test was made at the corners of Pico Boulevard and Figueroa Street in March last year. During that test, an ambulance from the Georgia Street Receiving Hospital several times sped through the intersection cleared by NATECS in advance of the vehicle.

The installation site of Florence and Western was selected by city traffic General Manager Lloyd M. Braff because of the presence of considerable electrical interference from sources such as power stations and transformers. It is believed that this interference will allow a true evaluation of NATECS under the most adverse conditions.

Realizing a need for advance control of traffic signals by emergency vehicles, North American put electronics to work for public safety in developing the system. According to Braff, at least 2,000 emergency vehicles are involved in accidents in the nation each year. In 1954, about 85 of these accidents involved a fatality.

With signals automatically clearing intersections up to one quarter of a mile ahead of racing emergency vehicle, NATECS was designed to prevent these types of accidents.

Know-how gained by the company in developing electronic brains for high-precision fire and flight control systems for airplanes and long-range guided missiles has been incorporated in NATECS.

Radically New, Lifetime Photo Cell Automatic Switches for Manhattan And Bronx Street Lights

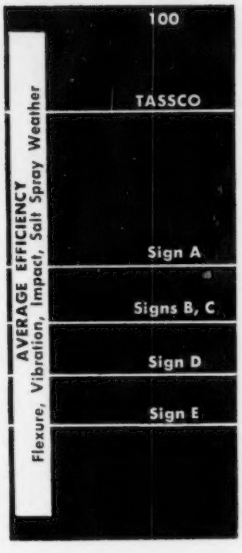
A new photo cell switch, which for the first time eliminates the use of tubes, is now being installed in 8,400 street lights in Manhattan and the Bronx. These switches are set to turn the street lights on and off automatically, according to the degree of daylight or darkness at each street light location.

The switches, which embody a new type of electric circuit and a sensitive photo cell no larger than a kernel of corn, were developed by Broadway Maintenance Corporation of Long Island City, N. Y., the concern which maintains the street lighting systems of both New York and Pittsburgh.

This new electronic development makes possible the use of a switch that is from one-half to one-quarter the size of switches heretofore used. Additionally, these new switches will last indefinitely whereas the old-type switches, which depended upon tubes, frequently failed due to the burning out of tubes.

The new Broadway Maintenance switch will also replace many of a still older type of street light control, the astronomical or electric clock switch. Many of these clock-type switches now control groups of five street lights. In the event of electric "feeder" line failure, astronomical switches involved in the area of electrical failure have to be reset one by one, after the electricity is restored. By using the new photo cell switches, the street lights in any area affected by electrical failure will automatically resume illumination when the current is restored.

the TASSCO story



"... Gentlemen: Tests for determination of durabiblity characteristics of 6 sets of test panels (signs produced by six different manufacturers) are now complete. It was desired to determine effects when subjected to flexing, resistance to vibration, ability to withstand impact, resistance to salt spray and weathering." *

THE RESULTS REPORTED WERE ANALYZED AND REDUCED TO GRAPHIC FORM. **The bar graph tells the Tassco story!**

Here's proof that Tassco All-Aluminum signs provide more strength, more resistance to deterioration, and more legibility for longer than five other leading makes! Tassco Signs, highly competitive in first cost, are obviously your municipality's finest investment for traffic, highway, road and street use.

Traffic and Safety officials are invited to write for the new Tassco catalog, and to use the Tassco advisory services without obligation.

*Excerpt from letter of report on tests conducted under the auspices of one of the nation's largest municipalities, under impartial laboratory conditions using standard testing equipment. Report is on file and may be seen on request.

The Sign of TASSCO *Traffic Safety*

TRAFFIC and STREET SIGN COMPANY

84 FOUNDRY STREET • NEWARK 5, N. J.

Contest Editors, TRAFFIC ENGINEERING
211 Strathcona Hall
Yale University, New Haven, Conn.

Please enter the enclosed picture(s) in the TRAFFIC ENGINEERING Contest which is submitted in accordance with the rules which I have read.

Name .....

Street .....

Town ..... State .....

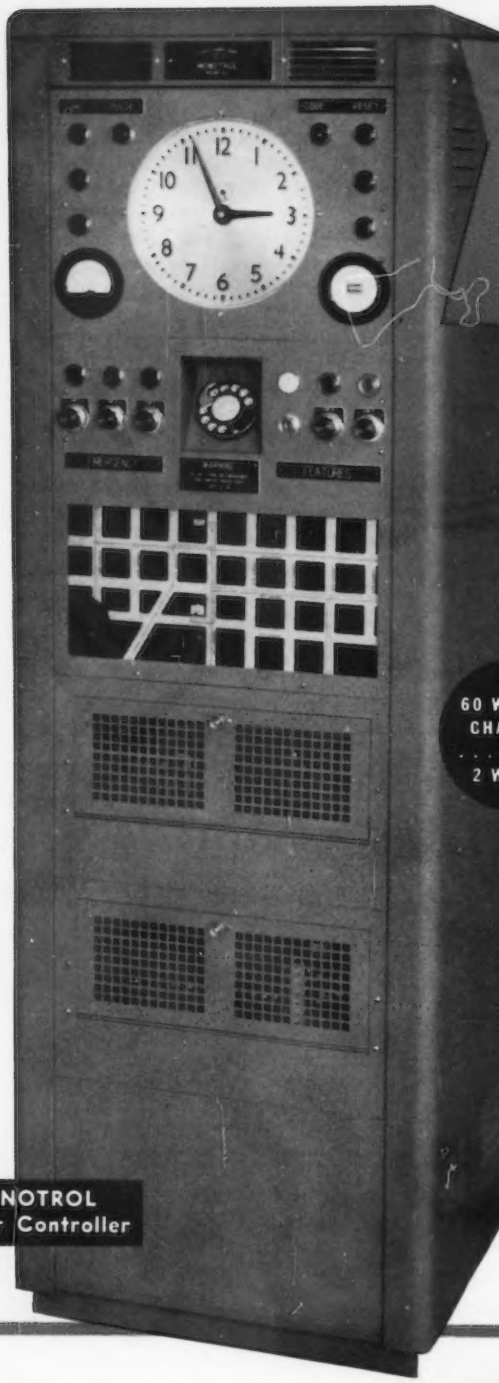
Published before? ..... Where? .....

Where made ..... Lens .....

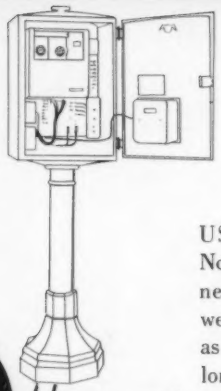
Camera used ..... Shutter Speed .....

Exp: Lens stop .....

Film used .....



NEW!



60 WEEKLY CHANGES . . . ALL ON 2 WIRES!

saves

USES PRESENT WIRING! Now, *any single circuit* interconnecting cable can handle the week's traffic program of as many as 60 function changes. It's no longer necessary to tear up streets and install expensive multi-conductor cable between master and local controllers. "Monotrol" will handle the problem with present wiring.

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(2) Automatically controls all functions of the most flexible synchronous system, up to a total of 18 functions.

(3) Allows fire, police and ambulance routes to be opened immediately by push-button.

(4) Permits unscheduled changes in function simply by dialing a number.

(5) Indicates on monitor panel that each function has been followed.

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over 50% of installation costs

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Fire Chief: "Just pushed a button and got a string of green lights right through town. Traffic cleared away . . . kept moving forward 'til drivers could pull over or turn up a cross street. Then, after we passed, the lights changed back to normal sequence automatically."

Police Chief: "First time since I've been Chief, a squad car made it across 13th Street without being blocked by traffic. The old system of flashing lights just caused traffic to jam up. Another advantage, only those lights along our route were altered — all others operated normally."

Mayor: "Sound investment, 'Monotrol'. It's paying off every day in smoother traffic flow and safety."

General Public: "I don't get held up for two or three light changes before I can work up to an intersection and cross it — even during rush hours." "Driving through town at 20, lights change to green before I arrive at each intersection." " 'Walk' lights let me cross the street without running." "Get home from work ten minutes sooner."

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Municipal Division
Moline, Illinois

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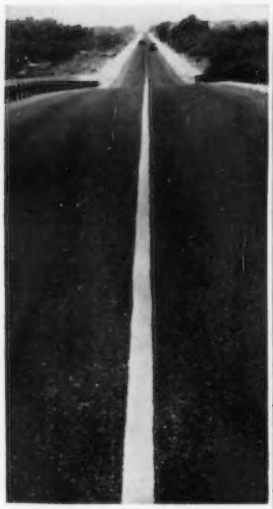

South Africa. Crystalex A laid for Cape Provincial Administration on Fly-over Bridge facing Cape Town.

WHAT IS CRYSTALEX??—

Crystalex is not a paint. It is not nailed, glued, or imbedded in the surface. It is a thermoplastic compound applied in a molten state at a high temperature to form a continuous line of any desired length or width.

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Section News

WESTERN SECTION

REPORT OF THE NINTH ANNUAL CONVENTION of the Western Section

Western Section activities over the past year culminating in a well attended annual meeting, indicates stature and maturity of this Section, the Ninth Annual Convention of the Western Section was told by Director **Joe Havenner.**

Registration at the convention, held in San Diego June 22-24, was 262 including 80 women guests. Eighty-four members welcomed new Section Officers **A. L. Hutchison, Al R. Pepper,** and **M. H. West.**

Highlights of the Technical Session included a challenging message by **Joe O. Mattson,** President of the Automotive Safety Foundation, urging cities and suburbs, and neighboring communities to get together and work out area wide transportation plans so as to bring an end to urban traffic congestion.

Joseph Barnett, U. S. Bureau of Public Roads, and **J. C. Young,** Engineer of Design, California Division of Highways, kept an audience of over 200 interested in new design concepts. **Mr. E. E. Wallace,** District Engineer, California Division of Highways, moderated "Metropolitan Freeways in Retrospect." Included in this high powered panel were **H. C. Higgins, E. E. Lewarch, J. A. Blickensderfer, P. O. Harding, Joseph Barnett,** and **Joe Havenner. O. W. Campbell,** City Manager, City of San Diego, and **Norm Kennedy** outlined the work of the sub-committees of the National Committee on Urban Transportation. **Harry Mathewson** enlightened an audience on "Assignment of Traffic Engineering Responsibility" and **Gran Parmelee** gave the "Advantages and Disadvantages of the Traffic Committees in Action" through his panel members **Guy McDonald, J. C. Gutting, L. S. Moore, Harry Clodfelter,** and **Bill Thien.** New developments in Traffic Engineering technique "What's New in the West" was ably moderated by **Al Hutchison.** Arizona was represented by **Caarls,** California by **Mathews and Moskowitz,** Colorado by **Bruce,** Idaho by **Mathes,** Nevada by **Ottini,** New Mexico by **Burton,** Oregon by **Crandall,** Washington by **Still,** and Honolulu by **Houghtailing.**

ITE members traveling over 2000 miles to attend this convention included **George Houghtailing** from Honolulu, **Joseph Barnett** and **Joe Mattson** from Washington, D. C., **Tim Todd** from New Haven, Connecticut, and **Don Opstad** from St. Paul, Minnesota.

Chief Putterer **Henberger** arranged for and won the Golf Tournament, Skinny **DeYoung** is still one of the great tennis players. **"Lucky" Luckenbach,** Chief Angler, helped a party of 24 bring in 6 yellowtail from Mexican waters off the Coronado Islands.

Thanks to the many supporting organizations, each of the non-technical events was a huge success.

M. H. West
Secretary-Treasurer

Fifth Annual Highway Planning Conference

On April 28 and 29 the Fifth Annual Highway Planning Conference of WASHO was held in Boise, Idaho. Approximately 12% of those registered at the Conference were members of ITE. Those included in this statistic are as follows: **E. R. Anderson,** BPR, Sante Fe; **R. C. Blensly,** DOH, Salem; **Elmer A. Clees,** DOH, Olympia; **C. K. Glaze,** DOH, Olympia; **J. Al Head,** DOH, Salem; **E. H. Holmes,** BPR, Washington, D. C.; **Ellis Mathes,** DOH, Boise; **Gerald Matthews,** DOH, Salt Lake City; and **J. K. Mladinov,** DOH, Olympia. The panel discussion on "Traffic Studies" was presided over by **Al Head. Bob Blensly** was a member of the panel which discussed "Motor Vehicle Use Studies."

Oregon Tales

FLASH!—The **Bergstroms** announced the arrival of their third daughter, **Dawn Denise,** who arrived on the scene at 4:30 A.M., Thursday, March 10th. Mother and daughter are both doing fine, but **Dawn's** brother and two sisters are suffering from acute loss of appetite brought on by **Don's** limited cuisine —if his can opener breaks, the whole family may perish.

Yosh Kosai is very much in the middle of the controversy relative to the Toll Road location through Tacoma and its access provisions and locations. He is battling like a "Little David," not only against state officials, but also the eastern consultant "Goliath." **Yosh** is still looking for an Assistant Traffic Engineer.

E. E. Lewarch is a sly shy little guy whom reliable sources report had his name connected with a recent article in "Time" magazine (a local competitor to WesternITE). This same source (**Al Mathews** by name) states that Seattle is the first city in the world to install Radar Traffic Detectors for actuated equipment.

Elmer Leland, a former associate of **Cysewski** Incorporated, made a hop, skip and a jump to work in Tacoma and then ended up with **Bob Dier** in Long Beach. **Jack Henderson** has taken **Elmer's** place on **Cy's** staff.

Jim Gallagher, Jr., District Traffic Engineer in Vancouver, Washington, is having a grand opening of his new 4-mile multi-million dollar depressed 60 mph Freeway on the 31st of March. **Jim** is going to give door prizes to the first five drivers having accidents on his new facility. The awards are tired tin traffic signals with gears ground to a 6 mph progression from off the old route.

Harry Aumack, T.E. of Spokane (Capitol of the Inland Empire) is trying to contact Houdini on the Ouiji Board to find out how to get his city transit out of the red — no one else seems to have the answer.

Margie and **Bruce Culver** had a pretty hot house warming in their new home in Seattle in February.

Herb Higgins is finally getting a much-needed breathing spell after 60 grueling days and nights as the Department's lobbyist, smoother of troubled waters and General of the steering committee at the Washington State Legislature.

C. K. Glaze is fast becoming known as the best informed man in the State on the planning and operation of freeways and toll roads. In the past month, he has been invited to make appearances before many civic, service, and professional groups. He is much in demand because of the informative and interesting presentation which he makes on the development, planning, and operation of major State highway and bridge facilities.

The Urban Design and Traffic School offered by the Bureau of Public Roads in Portland was attended by no less than 10 Western Section members: **F. B. Crandall, Fred Fowler, Yoshio Kosai, Dick Long, Lew Ross, Bruce Culver, Myron Mitchell, Don Bergstrom, Denny Peterson** and **Dave Schoppert. Al Head** and **Bob Blensly** attended on a part-time schedule. **Charles W. Prisk**, National Vice-President, was one of the three instructors.

The Oregon Area, always on the alert for sundry and assorted reasons for having an Area Meeting, rose to the occasion and scheduled a dinner meeting at the Roosevelt Hotel. **John Henberger**, A.G.A. West Coast Sales Manager, arrived on the scene just in time to stage a cocktail party for all hands before the dinner. Co-Chairman **Bergstrom** was so exhausted from making arrangements (and standing by the phone in anticipation of the word that **Shirlene** had presented him with a new tax exemption—his fourth) that he allowed **Dave Schoppert** to M.C. the meeting. No formal speakers were engaged but **Henberger** outlined the plans for the San Diego meeting and extended a hearty "Y' all Come" to those

(Continued on page 470)

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Membership Applications

The following applications have been received since the list of applicants published last month.

APPLICATIONS FOR TRANSFER

FINLAY, Redfield, Jr.
Traffic Engineering Assistant ,
Department of Traffic
City of Los Angeles
Los Angeles, California
July 11, 1955 for ASSOCIATE grade

FISCHER, Stewart Clarence
Traffic Engineer
City Hall
San Antonio, Texas
July 25, 1955 for ASSOCIATE grade

GILMAN, Roger Howe
Director of Port Development
The Port of New York Authority
111 Eighth Avenue
New York 11, New York
July 12, 1955 for MEMBER grade

LINDQUIST, Gordon G.
Assistant Director, Safety & Traffic Engineering Dept.
Chicago Motor Club
Chicago, Illinois
June 17, 1955 for ASSOCIATE grade

MEYER, Robert L.
Traffic Engineer
Nebraska Department of Roads and Irrigation (State Highway Department)
State Capitol
Lincoln, Nebraska
June 30, 1955 for MEMBER grade

NEW APPLICATIONS

ANDERSON, James H.
Senior Highway Engineer
California Division of Highways
Eureka, California
July 25, 1955 for MEMBER grade

ANDRAS, Joseph W.
Sr. Assistant Traffic Engineer
City of Cleveland
Cleveland, Ohio
July 5, 1955 for MEMBER grade

CARSON, William Lester
Acting Manager, Traffic Engin. Dept.
American Automobile Association
1712 G Street, N. W.
Washington, D. C.
July 25, 1955 for JUNIOR grade

DEC, Theodore
District Planning Engineer
U. S. Department of Commerce
Bureau of Public Roads
408 Highway Building (State)
Salem, Oregon
July 25, 1955 for ASSOCIATE grade

DOUGHTY, James R.
Traffic Commissioner
City of Hamilton
Room 301, City Building
Hamilton, Ohio
July 5, 1955 for JUNIOR grade

GATELY, Joseph E.
Traffic Survey Engineer
Oregon State Highway Department
State Highway Building
Salem, Oregon
July *, 1955 for Associate grade

HOUSE, Thomas Daniel, Sr.
Highway Planning Engineer
State Highway Department of Georgia
2 Capitol Square
Atlanta, Georgia
July 11, 1955 for MEMBER grade

KEEFER, Louis E.
Technical Asst. to State Planning Engr.
Planning Div. of State Road Commission of West Virginia
Charleston, West Virginia
July 5, 1955 for JUNIOR grade

MARLOW, Joseph Stephen
Highway Traffic Engineer II
Michigan State Highway Department
Planning & Traffic
Lansing, Michigan
July 8, 1955 for JUNIOR grade

MISCIMARRA, Anthony Fred
Traffic Planner
907 City-County Building
Pittsburgh 19, Pennsylvania
June 28, 1955 for ASSOCIATE grade

MOORE, Loran S.
District Traffic Engineer
California Division of Highways
San Bernardino, California
July 11, 1955 for MEMBER grade

NOERR, Karl
Highway Engineer Trainee
Virginia Department of Highways
1221 E. Broad Street
Richmond 19, Virginia
August 1, 1955 for JUNIOR grade

QUINN, Jay W., Jr.
Assistant Traffic Engineer
City of Charlotte, 600 E. Trade St.
Charlotte, North Carolina
July 25, 1955 for ASSOCIATE grade

RODGERS, Lionel M.
Chairman, Engineer Advisory Committee to the City Traffic Engineer
Philadelphia, Pennsylvania
June 17, 1955 for ASSOCIATE grade

SHUFFLEBARGER, Curtis L., Jr.
Civil Engineer I, Dept. of Public Service
Highway Division, Arlington County
Arlington, Virginia
July 14, 1955 for JUNIOR grade

VIVONI, William, Jr.
Chief, Traffic Safety Division
Department of Public Works
San Juan, Puerto Rico
June 27, 1955 for ASSOCIATE grade

LOOKING AHEAD

SEPTEMBER 8-10 — JACKSON LAKE LODGE, WYOMING
Western Association of State Highway Officials annual conference.

SEPTEMBER 12-14 — GATLINBURG, TENNESSEE
Annual national meeting Highway Conference for County Engineers and Officials.

SEPTEMBER 25-29 — MONTREAL, QUEBEC
Annual meeting of American Association for Planning Officials.

SEPTEMBER 26-29 — ROCHESTER, NEW YORK
Annual meeting of the International Municipal Signal Association, 60th Annual Convention, Hotel Seneca.

SEPTEMBER 26-29—BOSTON, MASSACHUSETTS
Annual convention of the American Transit Association, Hotel Statler.

OCTOBER 2-6—PHILADELPHIA, PENNA.
Annual conference of the International Association of Chiefs of Police.

OCTOBER 4-7 — COLUMBUS, OHIO
Annual Ohio Short Course on Roadside Development.

OCTOBER 5-8—BRETTON WOODS, N. H.
Annual convention of the International City Managers' Association.

OCTOBER 14-15—MEMPHIS, TENNESSEE
Fall meeting of the National Society of Professional Engineers, Peabody Hotel.

OCTOBER 17-21—CHICAGO, ILLINOIS
National Safety Council, 43rd National Safety Congress & Exposition, Conrad Hilton Hotel.

OCTOBER 24-27—PITTSBURGH, PENNA.
Founders' 25th Birthday Meeting of the Institute of Traffic Engineers, William Penn Hotel.

OCTOBER 24-28 — NEW YORK CITY
Annual meeting of the American Association of Civil Engineers.

DECEMBER 4-10—NEW ORLEANS, LOUISIANA
Annual meeting of the American Association of State Highway Officials.

JANUARY 11-14, 1956 — MIAMI BEACH, FLA.
Annual convention of the American Road Builders' Association.

Across the State of Arizona

"SCOTCHLITE" REFLECTIVE SHEETING guides traffic by COLOR

4-color reflective sign system gives safer, more efficient day and night traffic control

In Arizona, highway officials guide and protect motorists with a *color-coded* signing system drawn from the traffic spectrum. Night and day, each color communicates a specific action or message—alerts the motorist far in advance of the sign. Accidents are *prevented* before they start.

Because this system is reflectorized with Wide Angle Flat-Top "Scotchlite" Reflective Sheeting, it works at night when needed the most: in rain, snow or sleet . . . when signs are accidentally twisted or bent. Highway officials say these color-coded signs make traffic control more efficient, safer and enjoyable.

States like Arizona*, Washington, Michigan are communicating with motorists through the 4-color system. Investigate its many advantages for your area now. For FREE color-coded scale model sign faces of "Scotchlite" Reflective Sheeting write to: Minnesota Mining & Mfg. Co., Dept. TE-85, St. Paul 6, Minn.

*Arizona also uses other colors in their directional signing system.

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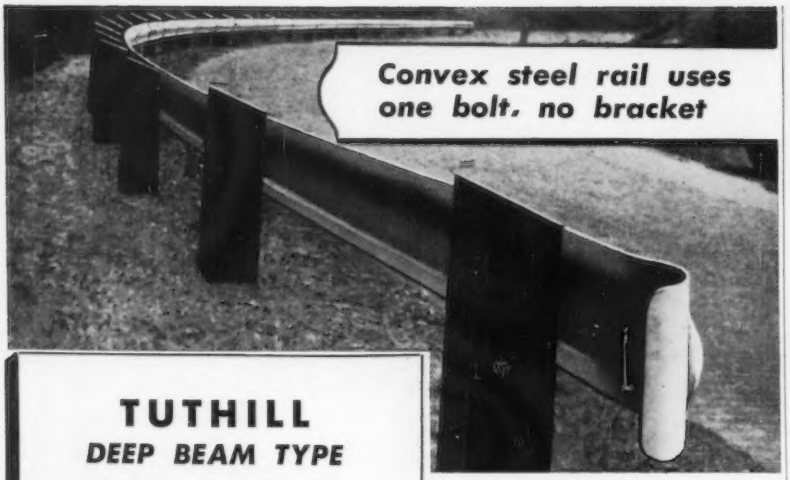

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SECTION NEWS

(Continued from page 467)

present. **Al Head** introduced **Charlie Prisk**, who said a few choice words in behalf of the National Organization, and **Dick Long** extended an invitation to those present to attend the Traffic Engineering Conference and Road Builders Clinic at Pullman, March 16-17-18th.

Bay Breezes

Bob Crommelin has accepted a part-time position as assistant to **Martin Wallen** in Richmond until Bob completes his studies for his Master's Degree at ITTE.

Art Philpott is about to join the "scramble amble" club. He is going to put a pedestrian interval system into operation this month in San Jose.

George Webb is about to release the long-awaited State Traffic Manual which has been in preparation for about ten years.

Dick and Mrs. Wilson, from Stockton, California, returned from old Mexico last month. They were forced to cut their vacation short because of the serious illness of **Mrs. Wilson's** father, from Pendleton, Oregon. They had planned to stay most of the summer, as **Dick** has so many ITE'rs on his staff that it practically runs itself.

Arizona Acclaim

July 10, 1955, **Chuck Haley** and **Larry Thompson** respectfully request the members of the Western Section to say a little prayer concerning the reversal of two one-way streets which will take place July 11. This plan has now been approved and plans are being drawn for the reversal. Specifically, we would like you to ask that **Chuck Haley** and **Larry Thompson** remember which way the streets are going to go so that they will not drive the wrong way themselves.

The "Battle of the Budget" has just been completed with **Larry Thompson** emerging victorious with some $240,000 for the Division of Traffic Engineering to be spent nickel by nickel. The first item eliminated was **Thompson's** requested trip to Salem, Oregon, to study the activities of the Oregon Highway Department. (We didn't really expect to send him, but there's no harm in asking.)

The latest fatality in the City of Phoenix occurred when a lady ran into a palm treet immediately in front of the home of former Traffic Engineer, **Wayne Morris. Haley** and **Thompson** are now in the process of removing all trees in front of their houses. If anyone would care for a slightly used palm tree, please write Traffic Engineering Division, Phoenix, Arizona.

John Caarls in Tuscon expects a hundred grand budget for next year which is a real increase.

Inter-Mountain Meditations
Colorado

Jack Bruce reports, with much satisfaction and delight, that in the recent Municipal Election, Denver taxpayers approved by a comfortable voting margin of almost 3 to 1 the issuance of $8,700,000 worth of bonds for the first phase of a $40,000,000 program to modernize the city's streets and traffic control facilities. Labeled "a cure for bumper-to-bumperism" by the local press, the bond issue will finance fifteen top priority projects and possibly five others of importance, representing a major attempt to deal with the city's worst traffic headaches. Approximately $250,000 will be expended for signal modernization alone which will affect traffic control in a sphere of one-fourth of the total metropolitan area, including two of Denver's heaviest-travelled arterials. No one can deny that Jack has quite a beanstalk to climb now!

The invasion of dust storms into parts of Colorado has posed a new problem in traffic control with the result that special emergency warning signs are being posted at storm centers during periods of blowing dust. The signs inserted in fixed pipe supports along the route carry the message "WARNING/VISIBILITY POOR/AT TIMES ZERO/ADVISE TO WAIT" and have proved quite effective in accident reduction. Interestingly enough, accident experience was negligible during severe dust storms of recent date through areas where centerline delineation was provided.

With a new batch of sixty recruits recently added to the State Patrol force, **Al Pepper** is once again stepping up to the rostrum to conduct an indoctrination course in traffic engineering for the benefit of the new enforcement officers.

The Colorado Department of Highways has descended upon certain State highway locations within Traffic Engineer **Paul Johnson's** bailiwick in Pueblo for an urban project in overhead sign research. Lane-suspended signs fabricated in aluminum are under experimentation to test all-around performance and public reaction to various color combinations and media of reflectorization.

Bill Foulis, former Director of the Colorado Highway Safety Council and now Western Representative for the Automotive Safety Foundation, has unwittingly been serving as an unofficial

roving ambassador for Western Section ITE, as his visitation schedule takes him from one member to another. For this live-wire contact service, we in the Inter-Mountain Area express our appreciation.

A progressive signal system is being installed in the Uranium Capital of Grand Junction, Colorado. Just think, says **Al Pepper**, someday we'll use the uranium for atomic power to operate the signals and then we'll really have a progressive system!

Salem Shenanigans

The Oregon Legislature has resulted in an increase in activity in the Traffic Division. **Bud George** and **Dennis Peterson** were called upon to explain the operation of the radar speed meter to one Legislative Committee which is debating the advisability of legalizing arrests made on radar speed meter evidence. **Bruce Crandall** twice entertained a horde of Eighth Grade Students who had come to the Capitol City to see the Legislature in action. **Bob Blensly** has been literally snowed under with requests for Vehicle Use and Truck Taxation information for various Legislative bodies.

(Continued on page 475)

YEARBOOK CHANGES

BATTS, Herman M., Jr. (Associate)
Traffic Engineer, Municipal Parking Authority, Room 103, Old City Hall, Detroit 26, Michigan.

BRITTON, George R. (Member)
Head Research Engineer, Pennsylvania Department of Highways, Planning Division. SEND MAIL: 4001 Ash Street, Harrisburg, Pennsylvania.

CLEARWATER, Louis L. (Junior)
Associate Traffic Engineer, Los Angeles Traffic Department. SEND MAIL: 8825 Ramsgate, Los Angeles 45, California.

DOWD, Allen J. (Junior)
Sales Engineer, Robert McMahon Company, 1107 Suburban Station Building, Philadelphia 3, Pennsylvania.

GROSS, Stanford P. (Associate)
Senior Assistant Traffic Engineer, Department of Streets and Traffic. SEND MAIL: 20522 Pierson, Detroit 19, Michigan.

HILL, George A. (Associate)
Assistant Engineer of Design, California Division of Highways, 1120 North Street, Sacramento, California.

HUNNICUTT, J. Madison, Jr. (Associate)
Traffic Engineer III, Bureau of Street Traffic & Parking, Room 902, 225 North Wabash Avenue, Chicago, Illinois.

LeCRAW, Charles S., Jr. (Member)
Project Manager, Market Development Division, U. S. Steel Corp., Pittsburgh 30. SEND MAIL: Sample Road, Allison Park, Pennsylvania.

LENTELL, Lynwood W. (Associate)
Associate Highway Engineer, California Division of Highways. SEND MAIL: 943 West Garland Avenue, Fresno, California.

LINGLE, Myron K. (Member)
Assistant Engineer of Traffic, Division of Highways, 8th Floor, State Office Building, Springfield, Illinois.

PARKER, Walter M. (Member)
Traffic Engineer, Macon-Bibb County Planning Commission. SEND MAIL. 3831, The Prado, Macon, Georgia.

RAY, James L. (Member)
Engineer, Coverdale & Colpitts, 120 Wall Street, New York City 5, New York.

ROSS, Lewis J. (Junior)
Assistant Traffic Engineer, Idaho Department of Highways. SEND MAIL: 5101 Targee Street, Boise, Idaho.

TAYLOR, Seymour S. (Associate)
Senior Traffic Engineer, Department of Traffic, Los Angeles. SEND MAIL: 3994 Beverly Glen Boulevard, Sherman Oaks, California.

No Bottleneck Here

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INSTITUTE AFFAIRS
OCCUPATIONAL ANALYSIS OF ITE MEMBERSHIP -- 1955

The 1955 ITE Yearbook lists the names, titles, and addresses of the 855 members of the Institute as of April of this year. A study was made to determine the occupations of the membership and a summary of these analyses is given below.

TABLE I

Classification of Members by Occupation

Type of Employment	Number	Percent
1. City Traffic Engineering	225	26%
2. City Planning	17	2%
3. City Employment — Other	20	2%
4. County Employment	24	3%
5. State Traffic Engineering	158	19%
6. State Planning	29	3%
7. State Employment — Other	29	3%
8. Bureau of Public Roads	15	2%
9. Federal Employment — Other	12	1%
10. College or University	29	3%
11. Commercial	82	10%
12. Trade Associations	65	8%
13. Consulting Practice	91	11%
14. Foreign Employment	34	4%
15. Unclassified	25	3%
	855	100%

Further analyses were made of some of the fifteen sub-divisions and is given below.

GROUP 1—CITY TRAFFIC ENGINEERING

There are 225 members of the Institute who are employed in city traffic engineering. This group is the largest of the fifteen and represents 26% or approximately one-fourth of the total membership. The following tabulation reveals the size of cities where these men are employed.

TABLE II

Location of City Traffic Engineers by Size of City

Population Group	No. of cities in Group	No. of cities in Group with ITE Members	Percent of cities with ITE Members	No. of Members Employed by each Population Group
Cities over 500,000	18	17	94%	104
Cities between 300,000-500,000	18	15	83%	34
Cities between 200,000-300,000	14	12	86%	21
Cities between 150,000-200,000	14	8	57%	12
Cities between 125,000-150,000	18	9	50%	12
Cities between 100,000-125,000	24	6	25%	9
Cities between 75,000-100,000	44	12	27%	14
Cities between 50,000-75,000	83	8	10%	8
Cities between 25,000-50,000	269	4	1.5%	4
Cities between 10,000-25,000	850	7	.8%	7

TABLE III

Number Employed by State

State	Traffic Engineers	Planning Engineers	Other State Employees
Alabama	1	—	—
Arizona	2	—	—
Arkansas	—	—	—
California	28	2	12
Colorado	2	—	—
Connecticut	9	1	—
Delaware	1	—	—
Florida	1	—	—
Georgia	—	2	—
Idaho	2	—	—
Illinois	14	2	1
Indiana	4	—	2
Iowa	—	—	—
Kansas	3	1	—
Kentucky	4	—	—
Louisiana	—	—	—
Maine	1	—	—
Maryland	—	—	—
Massachusetts	2	—	1
Michigan	16	2	1
Minnesota	3	1	—
Mississippi	3	—	1
Missouri	2	—	—
Montana	—	—	—
Nebraska	2	—	—
Nevada	1	—	—
New Hampshire	—	—	—
New Jersey	4	1	1
New Mexico	—	1	—
New York	2	2	5
North Carolina	1	1	—
North Dakota	—	—	—
Ohio	2	2	—
Oklahoma	1	—	—
Oregon	8	1	1
Pennsylvania	4	2	—
Rhode Island	1	—	—
South Carolina	—	—	—
South Dakota	—	—	—
Tennessee	—	—	—
Texas	6	—	2
Utah	1	1	—
Vermont	1	—	—
Virginia	9	—	—
Washington	9	4	2
West Virginia	—	1	—

Groups 5, 6, and 7—State Traffic, State Planning, and Other State Employment

The three categories of state employment (traffic, planning, and other) are presented together in one tabulation. There are a total of 216 members employed by states, 158 as traffic engineers, 29 as planning engineers, and 29 in other types of state employment. Nineteen percent of the total membership is employed as state traffic engineers and is the second largest occupational classification. The following table indicates the employment of these members by state.

Group 10—College or University

There are twenty-nine members who are on the faculties at Colleges and Universities. The following is a list of the colleges and universities and the number of members employed at each school.

TABLE IV

Members Located at Colleges and Universities

State	College or University	Number Employed
California	University of California at Berkeley	4
California	University of California at Los Angeles	1
Connecticut	Yale University	4
Illinois	University of Illinois	1
Illinois	Northwestern University	1
Indiana	Purdue University	3
Iowa	Iowa State College	2
Michigan	Michigan State College	1
New York	Brooklyn Polytechnic Institute	1
New York	Clarkson College of Technology	1
New York	Cornell University	1
North Carolina	North Carolina State College	2
Ohio	University of Toledo	1
Pennsylvania	Pennsylvania State College	1
Pennsylvania	University of Pennsylvania	1
Texas	Texas A. and M. College	1
Wisconsin	University of Wisconsin	1
Washington, D. C.	George Washington University	1
Havana	University of Havana	1
		29

Group 11—Commercial

Eighty-two of the members are classified in commercial occupations and they represent 10% of the total membership. Because of the great variety of occupations in this classification, the occupations have been grouped into four major categories.

TABLE V

Commercial Employment

Type of Employment	Number Employed
Electric Power Companies	11
Mass Transit Companies	30
Miscellaneous Commercial Enterprises	22
Traffic Equipment Companies	19
	82

Wisconsin	2	—	—
Wyoming	1	—	—
Canada	5	2	—
	158	29	29

Group 12—Trade Associations

There are sixty-five members of the Institute who are employed by trade associations. This group represents 8% of the total membership. A further analyses of occupations of this group is given in the table below.

TABLE VI

Trade Association Employment

Organization	Number Employed
Automobile Clubs	16
Civic Safety Groups	7
Insurance Companies	6
National Highway Safety and Research Groups	24
Miscellaneous	12
	65

Group 13—Consulting Practice

11% of the total membership (91 members) are engaged as consultants. The geographical distribution of the consultants is given in the table below. The ninety-one members are employed by fifty-seven consulting firms.

TABLE VII

Geographical Location of Consultants

Section	Number Engaged
Midwest	24
North East	39
South	19
West Coast	9
	91

Group 14—Foreign Membership (Other than Canada)

The Institute has thirty-four members who work outside of the United States and Canada. The geographical distribution of the foreign members is shown below by continents.

TABLE VIII

Foreign Membership

Location by Continent	Number Employed
Africa	5
South and Central America	10
Asia and Middle East	11
Europe	8
	34

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gives the motorist time to be safe!

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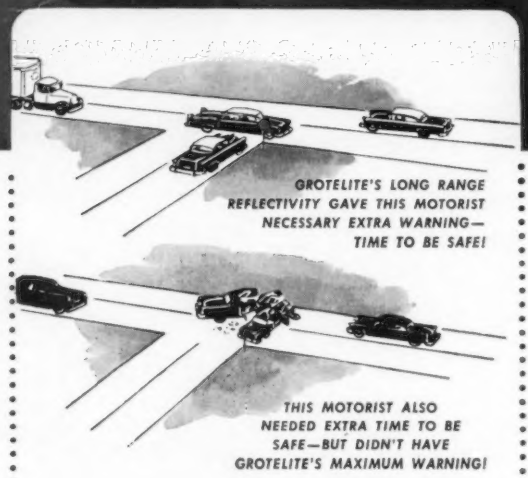
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EXAMINATION: A written examination to include tests of thorough knowledge of highway safety and traffic control; knowledge of the mathematics involved in highway engineering; ability to conduct surveys and to prepare reports.
SALARY: $483-$532 per month.
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Department of Civil Service and Personnel
Room 402, Civic Center
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REQUIREMENTS: Engineering degree with minimum of two years experience in traffic engineering work.
SALARY: Commensurate with experience.
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Office of the Mayor
City of Springfield
City Hall
Springfield, Illinois

CITY OF SAN ANGELO TEXAS

TRAFFIC ENGINEER—First traffic engineer for city.
REQUIREMENTS: College graduate with both training and experience in traffic engineering and approximately 30 years of age. Preference will be given to someone who has had some administrative training.
SALARY: Open.
Apply:
Del Green
City Manager
San Angelo, Texas

SECTION NEWS

(Continued from page 471)

Colorado Capers

Jack Bruce reports that the Denver Tramway Company will soon start scrapping the overhead trolley-bus lines to make way for a fleet of diesel-engine buses.

During the month of April, the Denver Traffic Engineer was host to two visitors from Washington, D. C., Traffic Signal Engineer **Charles Sullivan** and traffic Engineer **John Mitton.** The visiting engineers were particularly interested in Denver's master traffic control system and its mid-block speed control signals.

In a recent trip to the East, **Jerry Rothweiler** looked in on **Hank Barnes,** former Denver Traffic Engineer and now Director of Traffic for the City of Baltimore, and found **Hank** in good spirits with a handsome budget of better than two million dollars recently appropriated for the overhauling of Baltimore's traffic signal system. As a notable alumnus of Western Section, **Hank's** colorful activities have not lost their glitter in the Inter-Mountain Area.

Wanna Bet ? ? ?

Information recently received shows that citizens definitely want to be law-abiding if given half a chance. Requests for park benches at all of the bus stops in the city have been arriving in the Department of Traffic's mail bag ever since those new "No Standing" signs appeared. (Eh?)

A switch-engine moved slowly toward the grade crossing just as a truck-tractor combination approached. Undaunted, the truck driver continued onto the tracks despite the warning signals. The trucker's co-pilot was quick to suggest, "Whaddya say we go halfway across, then stop, and back up . . . just like they always do? ?"

MIDWEST SECTION

Snipped out of **Midwest ITE*MS, Dick Walons,** Editor.

Chicago Wins

Midwestern cities captured top honors for 1954 in the National Traffic Safety Contest conducted by the National Safety Council.

Wausau, Wisconsin, won the grand award for the second year in a row.

Chicago, Illinois, topped all of the "big" city entries, winning first place among cities of one million or more population.

In their respective population groups, **Minneapolis, Minn.,** won second honors, while **Peoria** and **Evanston, Ill.,** each took the third place spots.

Other honors were given to the cities of **Wilmette, Winnetka,** and **Oak Park, Illinois.**

The victories were especially satisfying to traffic engineers of the winning communities. Traffic engineering activities in each city were key factors in their success. **Chicago,** generally an also-ran in previous contests, finally received recognition for increasing accomplishments in traffic engineering safety.

The contest, conducted by **Harry Porter,** had as judges Midwest ITEs **Dick Bennett, Ed Klamm,** and **Matt Sielski,** along with several other national ITE members.

Meet Charlie Michalski

One of the names synonymous with the Citizens Traffic Safety Board of Chicago is that of **Charlie Michalski.** Yet his fame reaches across the United States and even to far-off Africa, since

Charlie has done active traffic engineering work in many places outside of the Chicago area.

His traffic engineering career began in the city of his birth, Detroit, Michigan. Charlie had attended Wayne University in that city, receiving a B.S. degree in electrical engineering in 1939. Soon thereafter he began work for the Traffic Engineering Bureau of Detroit, drafting and doing traffic and accident analyses. He soon rose to head the Traffic Signal Division, but in 1943 the war interrupted his career.

Charlie was schooled by the Navy in radio and radar at Bowdoin College and M.I.T., and as a result served on a task group commander's staff as Radio and Radar Material Officer. He was a busy man until discharged following the war's end.

MISSOURI VALLEY SECTION

Taken from the Missouri Valley Monthly Paper, **George C. Lichty**, Editor.

Annual Section Meeting

On the afternoon of April 15th the Missouri Valley Section members met in Kansas City in the office of **J. A. Hutter** for the Annual Section Meeting. The seventeen members present portray our growing membership and interest in the Section.

President **Joe Feuchter** presided in his usual pleasant and businesslike manner.

The Treasurer, **Woody Rankin**, presented the final report on the Silver Anniversary Convention fund. Balance on hand $891.80; approved contribution to the Theodore M. Matson Memorial fund $600.00; balance transferable to Section funds $291.60. Balance on hand in Section funds April 15, 1955, $50.54. Total balance in Section Fund after transfer of Convention fund $342.14.

President **Feuchter** also stated that the Section has paid all expenses to the National Office of the ITE that were due that office from the Silver Anniversary meeting, including the payment for all of the Secretarial reporting in the technical sessions (which was no small amount).

President Joe urged those present to continue their efforts toward obtaining new members for the Institute.

The following appointments were made to round out our good working Section organization. **Bob Meyer**, Chairman Membership Committee; **George Fisher**, Historian; **Leon Corder**, Corresponding Secretary and Associate Editors—**Hutter, Basile, Whedon, Lauer, Burton, Corder, G. F. Fisher, Meyer, Feuchter, Hoffman** and **Bierman.**

The following officers elected for the coming year are:

President: **Joseph J. Feuchter.**
Vice-President: **Robert L. Meyer.**
Secretary - Treasurer: **Woodrow W. Rankin.**

Welcome New Members

We take this opportunity to greet the following who have recently become members of the Institute or have transferred into the areas of the Missouri Valley Section.

Paul C. Box, Street Lighting Engineer for the Traffic Department of Kansas City, Missouri.

Henry M. DeNoble, former Director of Planning and Traffic in Lubbock, Texas, is now Director of Planning and Traffic for Springfield, Mo.

Dale Edwin Dugan, Highway Planning Department, State Highway Commission of Kansas, Topeka, Kansas.

Donald E. McCarthy, Traffic Control Section for the Kansas City Power and Light Company.

Guido Moss, Manager of Research and Schedules, St. Louis Public Service Co., St. Louis, Missouri.

And our New Affiliate Section Member **Harry D. Griffith**, Traffic Control Section, Missouri State Highway Department, Jefferson City, Missouri.

Kansas

Columbia Traffic Conference

From **A. J. Basile** and **J. F. Barclay**

Those of us from Kansas Highway who attended the conference at Columbia, Missouri, certainly enjoyed an excellent and informative program. The College of Engineering, the Missouri State Highway Department, the Missouri Municipal League and ITE Section are certainly to be commended for a well-planned diversified program. We believe more subjects of the type presented by **Bob Meyer** and **Willard W. Fryhofer** should encourage increased attendance and interest by traffic and highway engineers.

New Sign for Hot Mix Jobs

The Traffic Department has designed a special sign to be used on Hot Mix jobs, where traffic is carried through construction.

The sign is 24" x 48" with a white background and black copy. The message on the sign is "PILOT CAR" "DO NOT PASS." The sign is erected on the back of the contractor's pickup. The pickup is then used by the contractor to guide traffic through construction.

NEW ENGLAND SECTION

The Spring meeting of the New England Section was held jointly with the 34th Annual Massachusetts Safety Conference at the Hotel Statler in Boston on March 22. **Edward J. McCarthy**, Highway Traffic Engineer of the Massachusetts Department of Public Works served as Chairman of both ITE sessions. In the afternoon a panel, composed of **Bruce Campbell**, Manager of the Massachusetts Safety Council, Commissioner **John A. Volpe** of the Massachusetts Department of Public Works, Commissioner **Charles W. Greenough** of the Metropolitan District Commission and Registrar **Rudolph F. King** of the Massachusetts Registry of Motor Vehicles, discussed the Boston Master Plan, highway engineering and safety. The dinner meeting was well attended and the speaker, **Philip H. Kitfield**, Chief Engineer of the Massachusetts Turnpike Authority, discussed the financing and engineering features of the Massachusetts Turnpike.

Reported by
DAVID S. JOHNSON, JR.
Secretary-Treasurer

MICHIGAN SECTION

The Michigan Section of the Institute of Traffic Engineers held its annual election of officers at the Warren Valley Country Club in Dearborn, Michigan, on Tuesday, May 10. Officers for the coming year are President, **Edward F. Gervais**; Vice-President, **Alger F. Malo**; Secretary-Treasurer, **Allen T. Hayes**. The retiring President **Sven Kansman**, conducted a short business meeting and then turned the meeting over to the new President. **Samuel J. Levine** was appointed Program Chairman for the coming year and Mr. Levine promised the members a series of interesting meetings held at various locations for the forthcoming year. The next meeting place will be the Rotunda Inn at Pontiac, Michigan.

The afternoon of golf was dampened by a drizzling rain and only the more hardy of the members engaged in this activity.

The social session was conducted after the close of the business meeting was adjourned.

Reported by **Allen T. Hayes**
Secretary-Treasurer

Letter to the Editor

We have experienced considerable difficulty in maintaining counter hose installations in the City of Richmond. Mr. William E. Burnette, Traffic Investigator, who was employed in the bureau several months ago has come up with what we consider an ideal application, and we pass it on for whatever value it may have to other traffic engineers. The source of our difficulty was primarily due to truck traffic, particularly on U. S. Route 1. The situation became so critical that it was necessary on frequent occasions to install several counters at the same location in order to assure ourselves of an accurate count throughout the period. Even with the dual application it ultimately developed that we frequently found need for triple installation of counters.

The counter failures were rarely of a mechanical nature, but the result of vehicle operators braking their units while on the hoses, which would uproot the hose clamps and nullify the counter. Mr. Burnette attempted to use spikes rather than masonry nails but this was impossible in most locations due to the fact that the underlying concrete could not be pierced by the spikes.

As a result of the difficulties experienced, Mr. Burette designed the clamp

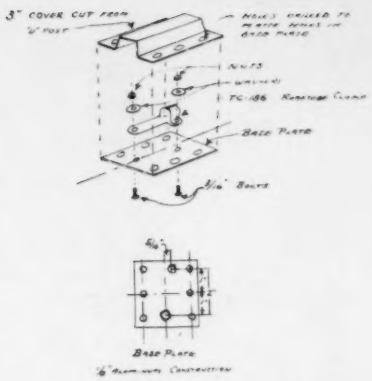


plate as shown in the sketch attached. This plate is used in toto at locations where the clamp is exposed to heavy traffic, however, at locations where the clamp is not too exposed the three-inch section of standard U-post can be omitted. The plates and covers were fabricated in our Paint Shop from standard one-eighth inch aluminum sign plate and three-inch sections of U-post for the cover. During the July 4th weekend the plates were used in test installations along Broad Street and on Robert E. Lee Bridge. During the period of test a total of 231,549 vehicles of which 108,930 were eastbound and 122,619 westbound, crossed these counter hoses. Every installation withstood the traffic volumes without failure. When we compare that experience with past experience, the development is 100% effective, and we have undertaken a program to manufacture a sufficient stock for all future needs. As mentioned above, the clamps are relatively easy to fabricate since they simply consist of a 3x3-inch metal plate drilled with eight holes. The holes drilled for the machine bolts were 3/16 inches, while those for the masonry holes on the outer edge of the plate are ¼-inch drills. The bolts must be inserted from the bottom of the plate in order that the clamp may be loosened for hose adjustment. The clamp used is a standard TC-186 road tube clamp.

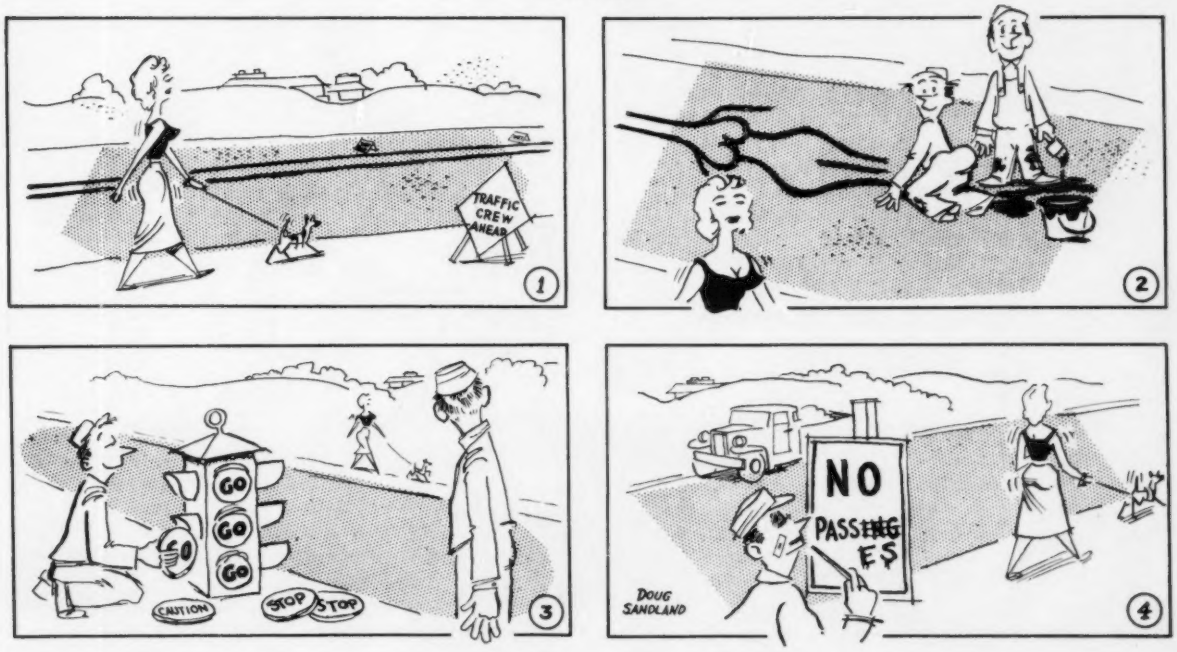
The placement of our counter hoses is a matter which varies with the situation. In those instances when we wish to obtain lane counts, individual counters are placed for each lane and the hose ends are clamped in place on the lane lines as well as at the counter. The same applies when we obtain counts on two-way streets and wish to determine the exact number moving in each direction.

We trust the results of Mr. Burnette's endeavor will prove of value to other traffic engineers.

W. S. WHITE, JR.
Traffic Operations Engineer
City of Richmond
Richmond, Virginia

July 11, 1955.

FUNNIES?



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What? Founders 25th Birthday Meeting

Who? The Institute of Traffic Engineers

Where? Pittsburgh, Pennsylvania

When? October 24-27, 1955

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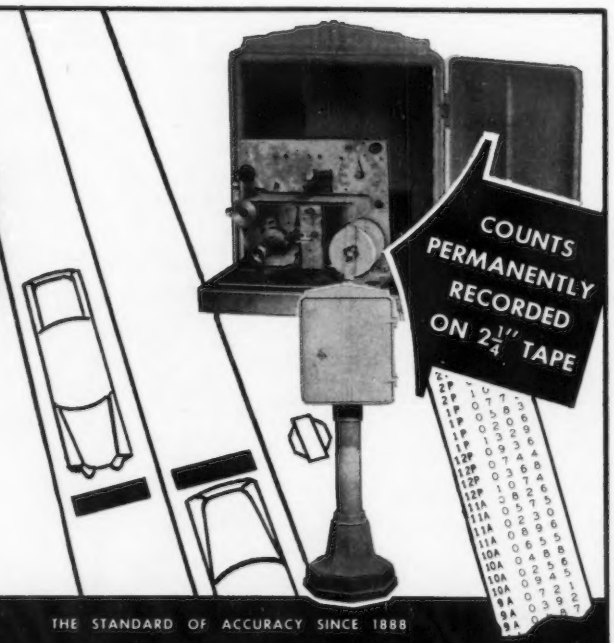

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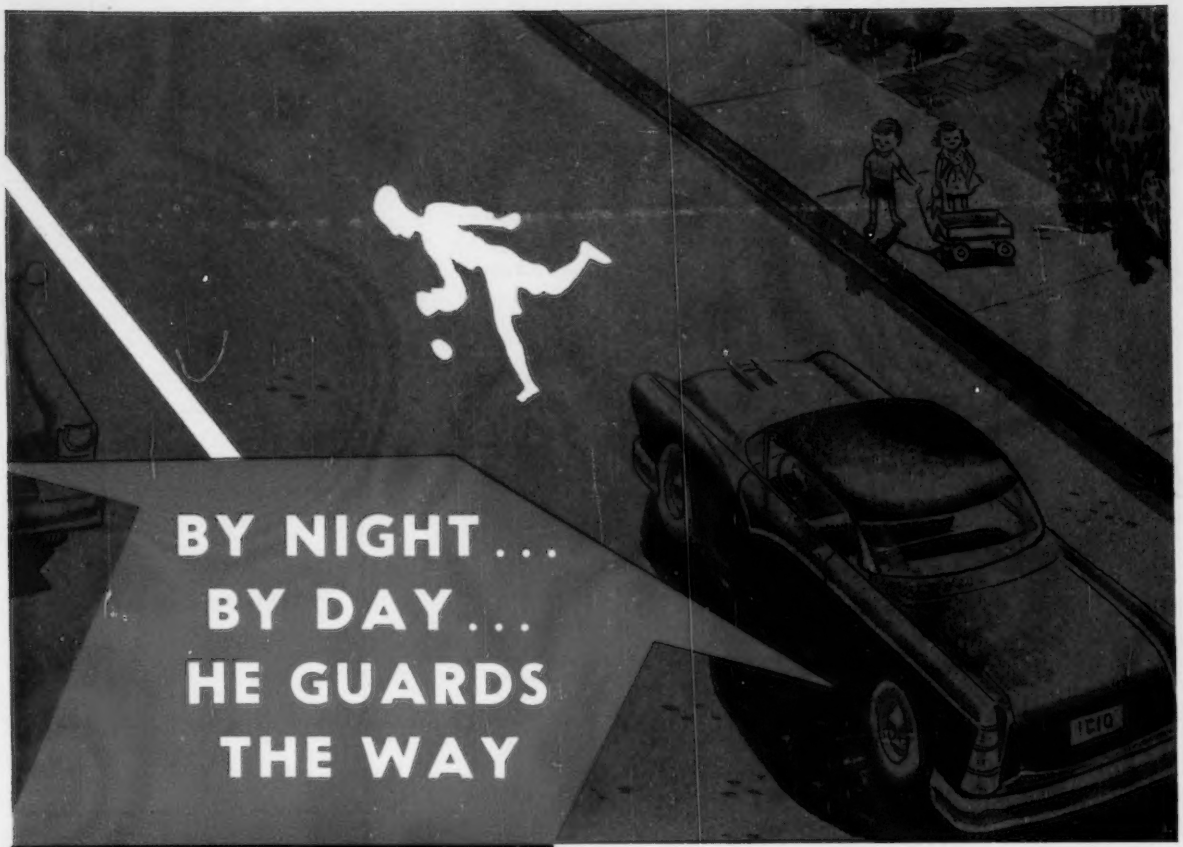

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